

**Three Sisters Springs Unit of Crystal River National Wildlife Refuge:
Aquatic Habitat and Wildlife-Viewing Improvements
Citrus County, Florida**

Environmental Assessment

Prepared by:

**U.S. Fish and Wildlife Service
Crystal River National Wildlife Refuge**



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Executive Summary

The U.S. Fish and Wildlife Service (FWS or Service) proposes to improve Florida manatee-viewing and habitat in Three Sisters Springs (the Springs), a 1.5-acre unit of Crystal River National Wildlife Refuge (Crystal River NWR or the Refuge), mostly enclosed freshwater habitat within the city limits of the Municipality of Crystal River and wholly within Citrus County, Florida. Within the greater Kings Bay, the Springs, comprised of three ‘lobes’ – Pretty Sister, Deep Sister, and Little Sister (also known as Hidden Sister) – is part of an important winter habitat for federal- and state-listed endangered Florida manatees in northwest Florida, a region that supports approximately 12 to 17 percent of the entire population of this subspecies (2014 & 2015 Manatee Synoptic Surveys – Fish and Wildlife Research Institute). During colder winter months, manatees are attracted to the Springs consistently warmer (72°F) spring-fed waters that they use as a thermal refuge. These warmer waters are vital for manatee thermoregulation due to their specific physiology that is lacking in functional insulation against the cold. Without access to these refugia, they are subject to potentially lethal cold stress syndrome. Over the past several years, increasing numbers of manatees, including mother-calf pairs, have been entering the Springs to rest and nurse their calves.

Visitors and local residents are also attracted to the Springs clear waters. During the winter months, they come primarily to see manatees while snorkeling, paddling/canoeing, and for manatee observations from land on the surrounding boardwalk. Wildlife photography is also a popular activity in and around the Springs. With increasing public attention to and popularity of the site, over the past several years, increasing numbers of visitors are recreating in the Springs. Without appropriate management actions, recent observations and monitoring suggest that during winter months, resting and nursing manatees have the potential to be disturbed by increasing numbers of visitors in the Springs. Additionally, without appropriate management actions, manatees also have the potential to be disturbed by large numbers of recreationists entering and exiting the Springs via the spring run – the narrow, in-water entrance to the Springs. These crowded conditions in a confined habitat may unintentionally displace or change manatees’ behaviors in relation to their vital need to thermoregulate in the Springs.

Crystal River NWR was created to the endangered species, specifically focusing on the West Indian manatee (*Trichechus manatus*). Secondary purposes of the Refuge include providing for appropriate fish and wildlife-oriented recreation, the protection of natural resources, and the conservation of additional endangered and threatened species.

The objectives for Crystal River NWR include:

- 1) To provide habitat and protection for the Florida manatee consistent with the requirements of the ESA, MMPA, and the Florida Manatee Sanctuary Act.
- 2) To foster a sense of public commitment to and understanding of the plight of the manatee and its need for protection by providing opportunities for environmental education, interpretation, and sustainable wildlife-dependent recreation.
- 3) To support the Service's commitment to implement and carry out the objectives of the nationwide Manatee Recovery Plan.
- 4) To provide habitat for the natural diversity of wildlife species.

Additionally, The National Wildlife Refuge System Improvement Act of 1997 Act which defines the “big six” public use objectives also applies to the Refuge. These objectives are the following: hunting, fishing, wildlife observation and photography, environmental education and interpretation to develop the public’s appreciation for fish and wildlife.

Three alternatives are proposed to improve wildlife viewing, increase public safety, avoid the potential for manatee disturbance during the winter season, and safeguard increasingly important manatee habitat at the Springs. In accordance with 50 CFR §25.21(e), under all of these alternatives, the Refuge may implement emergency closures of the Springs, and such closures may occur at any time to safeguard resources, including manatees, and/or for public safety. These alternatives are outlined below.

A) No Action: The No Action Alternative maintains existing management measures within the Springs and the spring run during manatee season, but does not provide any additional measures. Existing management measures in the Springs include:

- Enforcing the current twelve prohibitions (see pages 23-24);
- Promoting public and visitor education regarding ‘Passive Observation’ via ‘Manatee Manners’ outreach materials;
- Providing wildlife and nature interpretation and public education via seasonal, professional nature interpreters on the boardwalk;
- Prohibiting entrance to the Springs between official sunset and official sunrise;
- Prohibiting scuba diving and fishing including, but not limited to, fishing by hook and line, by cast net, or by spear;
- Evaluating the Springs on a daily basis, during manatee season, and opening or closing the Springs to in-water, recreational access in response to estimated or actual manatee numbers in/around the Springs; and also evaluating key environmental factors (i.e., actual or estimated manatee numbers from counts in the Springs, the spring run, and areas at the mouth of the run, tide heights measured within the Springs, ambient sea water temperatures from Shell Island U.S. Geological Survey (USGS) weather monitoring station, and ambient water temperatures from the canal entrance to the spring run);
- Continuing federal and state law enforcement efforts to cite and prosecute disturbance and harassment of manatees under 50 CFR 17.3 and 18.3, the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA);
- Continuing to actively engage visitors and the community via outreach and communication partnerships with local stakeholders and institutions in manatee conservation efforts;
- Supporting the Southwest Florida Water Management Districts’ (SWFWMD) bioengineering project stabilizing the Springs shoreline to address bank erosion.

B) Manatee Viewing from Land Only: Alternative B would protect resting and nursing manatees from potential disturbance by closing the Springs to all in-water access during the manatee season, while providing enhanced land-based manatee viewing opportunities for visitors. Additionally, this alternative would protect manatee habitat by stabilizing the Springs eroding banks and limiting the threat of epizootic disease transmission by

banning pets. Pets may carry communicable diseases that could have an adverse effect on visitors and manatees (Bossart *et al.* 2012).

The following management measures from Alternative A would be included in Alternative B. They are:

- Enforcing the current twelve prohibitions (see pages 23-24);
- Promoting public and visitor education regarding 'Passive Observation' via 'Manatee Manners' outreach materials;
- Providing wildlife and nature interpretation and public education via seasonal, professional nature interpreters on the boardwalk;
- Continuing federal and state law enforcement efforts to cite and prosecute disturbance and harassment of manatees under 50 CFR 17.3 and 18.3, the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA);
- Continuing to actively engage visitors and the community via outreach and communication partnerships with local stakeholders and institutions in manatee conservation efforts;
- Supporting the Southwest Florida Water Management Districts' (SWFWMD) bioengineering project stabilizing the Springs shoreline to address bank erosion.

The following additional management measures would be implemented under this alternative:

- Prohibiting all in-water access (swimming, paddlecraft, etc.) to the Springs and provide access to the Springs for manatee viewing, nature interpretation, and public education from Americans with Disabilities Act (ADA) compliant boardwalks and elevated viewing platform(s) only;
- Improving existing boardwalks to comply with ADA and public safety standards for improved views of the springs, wildlife viewing, and recreational photography;
- Prohibiting pets on the boardwalk, shoreline, and in the water at the Springs and the spring run;
- Constructing an ADA-compliant elevated viewing platform to allow for improved views of the Springs, wildlife-viewing, and recreational photography;
- Providing additional interpreters on the boardwalk for public education;

C) Proposed Alternative: As in Alternative B, Alternative C would protect manatee habitat by stabilizing the Springs eroding banks and by limiting the threat of epizootic disease transmission by restricting pets. Also, as in the previous alternative, Alternative C would provide enhanced land-based wildlife viewing opportunities for visitors. Additionally, this alternative would allow for limited, guided in-water manatee viewing.

The following management measures from Alternative A and B would be included in Alternative C. They are:

- Enforcing the current twelve prohibitions (see pages 23-24);
- Promoting public and visitor education regarding 'Passive Observation' via 'Manatee Manners' outreach materials;

- Providing wildlife and nature interpretation and public education via seasonal, professional nature interpreters on the boardwalk;
- Prohibiting entrance to the Springs between official sunset and official sunrise;
- Prohibiting scuba diving and fishing including, but not limited to, fishing by hook and line, by cast net, or by spear;
- Continuing federal and state law enforcement efforts to cite and prosecute disturbance and harassment of manatees under 50 CFR 17.3 and 18.3, the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA);
- Continuing to actively engage visitors and the community via outreach and communication partnerships with local stakeholders and institutions in manatee conservation efforts;
- Supporting the Southwest Florida Water Management Districts' (SWFWMD) bioengineering project stabilizing the Springs shoreline to address bank erosion.
- Improving existing boardwalks to comply with ADA and public safety standards for improved views of the springs, wildlife viewing, and recreational photography;
- Prohibiting pets on the boardwalk, shoreline, and in the water at the Springs and the spring run;
- Constructing an ADA-compliant elevated viewing platform to allow for improved views of the Springs, wildlife-viewing, and recreational photography;
- Providing additional interpreters on the boardwalk for public education;

The following additional management measures would be implemented under this alternative:

- Closing all in-water access to the Springs via the narrow spring run, during manatee season (November 15 to March 31, with designations for closures that may be made prior to November 15 and after March 31 during cold fronts when manatees are present);
- Providing in-water access to limited numbers of visitors, daily, via fee-paying and limited commercial special use permit(s) (SUPs) from an ADA-compliant floating dock and ramp attached to the improved boardwalk; in-water, guided manatee viewing would be available during the hours of 10 a.m. and 4 p.m. daily, except during emergency closures;
- Requiring guides, certified by FWS, to accompany and supervise visitors during in-water tours, and the Refuge would standardize guide certification for the Springs during manatee season;
- Requiring and limiting SUPs for the use of any type of flash photography in the Springs; SUPs for diffused flash photography would be issued for educational or research purposes only;
- Amending the SUP conditions for commercial wildlife observation guides using the Springs to require the following specific stipulations – a City of Crystal River business license or exemption letter and in-water insurance for clients;
- Closing two lobes (Pretty Sister and Little Sister) to in-water access, as necessary, during manatee season, and as needed in response to key environmental factors (i.e., actual or estimated manatee numbers from counts

in the Springs, the spring run, and areas at the mouth of the run, tide heights measured within the Springs, ambient sea water temperatures from Shell Island USGS weather monitoring station, and ambient water temperatures from the canal entrance to the spring run), or at the discretion of Refuge management;

- Instituting a standard of conduct for SUPs , guides, clients, and in-water visitors that supports and promotes responsible, sustainable wildlife viewing;

This Draft EA evaluates strategies to manage human / manatee interactions at Three Sisters Springs, a unit of the Crystal River NWR. Alternative C is the Service-preferred alternative. The document explores program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. This document does not constitute a commitment for staffing, operational, or maintenance increases. Those decisions are at the discretion of Congress in overall appropriations and in budget allocation decisions made at the Washington and Regional levels of the Service.

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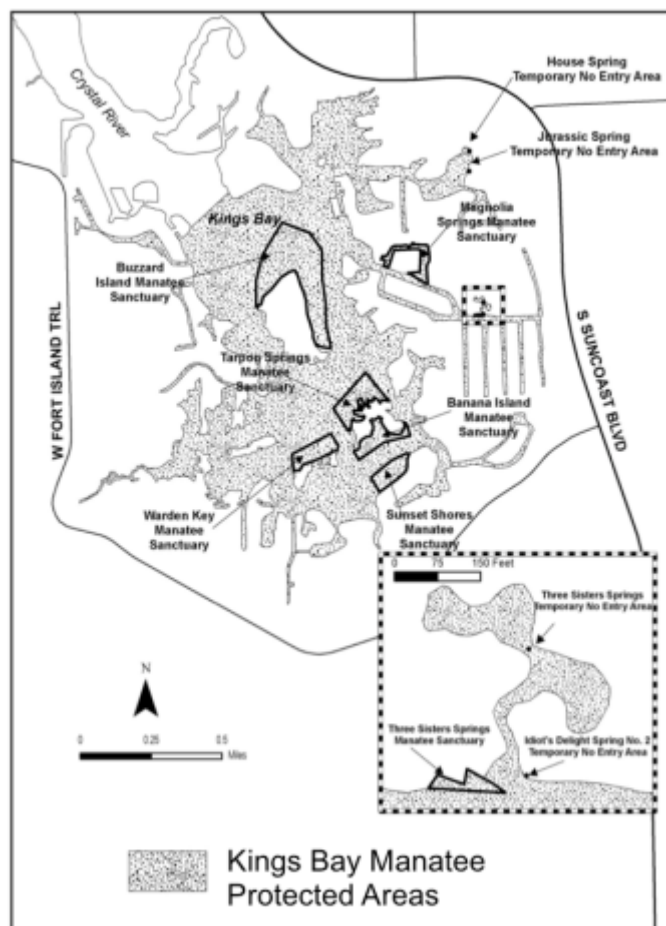
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1.1 Introduction

This Environmental Assessment (EA) addresses proposed actions to improve wildlife viewing where large numbers of recreational snorkelers and users of non-motorized vessels currently use a relatively small area to view Florida manatees, in their winter habitat where the animals rest and nurse their calves. This EA also addresses proposed actions to improve Florida manatee



habitat. The proposed actions of this EA would occur in the shallow, freshwater springs (1.5 acres) called Three Sisters Springs (the Springs), a unit of Crystal River National Wildlife Refuge (Crystal River NWR or Refuge), and in the spring run connecting the Springs to a canalized section of Kings Bay (Figure 1). The Springs themselves are situated on the larger property (57.1 acres) also known as Three Sisters Springs. The Springs consist of three springheads, Pretty Sister, Deep Sister, and Little Sister.

Figure 1. Kings Bay Manatee Protection Area and Three Sisters Springs

1.1.1 Status of the Florida Manatee

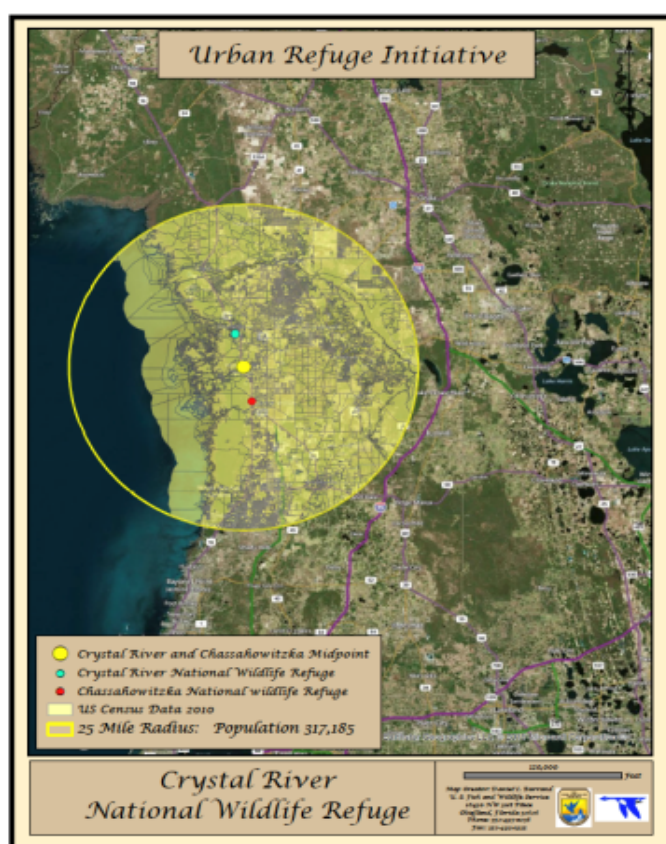
The West Indian manatee (*Trichechus manatus*) was listed as an endangered species on June 2, 1970 (35 FR 8491), under the Endangered Species Act of 1969 (ESA). The population is further protected as a depleted stock under the Marine Mammal Protection Act

(MMPA). The West Indian manatee includes two subspecies: the Florida manatee (*Trichechus manatus latirostris*) and the Antillean manatee (*Trichechus manatus manatus*). As the Antillean manatee does not occur in Florida, references in this document to “the manatee” or “manatees” are specific to the Florida manatee, unless otherwise noted.

The Florida manatee can be found throughout the southeastern United States, with Florida at the core of its range. The 2015 statewide aerial survey counted 6,063 manatees, with 3,333 counted on the east coast and 2,730 on the west coast (2015 Manatee Synoptic Survey – Fish and Wildlife Research Institute). Given these counts, Citrus County is home to perhaps as many as 17 percent of the southeastern United States’ manatee population. The Service and the Florida Fish and Wildlife Conservation Commission (FWC or the Commission) continue to work in collaboration, along with manatee scientists and other experts, to recover this species via the Florida Manatee Recovery Plan of 2001 and the Florida Manatee Management Plan (2007). In particular, significant efforts are made to minimize human-related threats.

On October 22, 1979, the Service adopted a regulatory process to provide a means for establishing manatee protection areas in waters under the jurisdiction of the United States where manatees were taken by waterborne activities (44 FR 60964). The first manatee protection areas were designated in Kings Bay, Citrus County, Florida, on November 12, 1980, for the purpose of preventing the take of manatees by harassment from waterborne activities. These included the Banana Island Sanctuary (including King Spring), the Sunset Shores Sanctuary, and the Magnolia Springs Sanctuary (45 FR 74880). The Service subsequently designated four additional manatee protection areas in Kings Bay on May 12, 1994, and on October 16, 1998 (including the Buzzard Island, Warden Key, Kings Springs, and Three Sisters Springs sanctuaries, respectively) (59 FR 24654 and 63 FR 55553). Today, the Service manages these sanctuaries.

1.1.2 Natural History of Three Sisters Springs



Three Sisters Springs is located at the eastern edge of Kings Bay and at the headwaters of the Crystal River. Being within the city limits of Crystal River itself, the lands and waters may be considered an urban wildlife refuge (Figure 2). The Springs and the property they are on, also called Three Sisters Springs, are bounded to the north by Kings Bay Drive, to the east by Cutler Spur Boulevard, and to the south and west by dredged navigational canals.

Figure 2: Population within 25 miles of Crystal River NWR = 300,000 people. In 2014, visitation was 327,654, making Crystal River NWR the fifth most visited refuge in the nation with 265,557 visitors (83 percent) accessing refuge waters, making Crystal River NWR the most in-water visited refuge in the United States (Commercial Special Use Permit (SUP) Visitors Reports 2014 for Crystal River NWR).

Prior to extensive development in and around the City of Crystal River, the site consisted of a forested wetland system that surrounded the Springs. A 1944 aerial photograph shows that the forested area surrounding the Springs extended further to the south than it does presently (Figure 3). By 1974, a residential canal was excavated that forms the present southern boundary of the Springs site (GoogleEarth).

In 1981, the former landowner placed over 40 large limestone boulders along the banks and the middle of the spring run entrance to the Springs to prevent motorboat access to the interior of the springs. Then in 1982, given that motorized vessels were accessing the Springs by visitors walking vessels with raised motors to the interior of the springs, the landowner installed six pilings at the entrance of the spring run, 36 inches apart from each other, to block access to larger

boats, while allowing paddlecraft and swimmers/divers into the Springs. After obtaining management authority for the Springs, refuge staff in consultation with state partners at FWC (as part of the Manatee Habitat Working Group, a sub-team of the former Florida Manatee Recovery Team) removed 20 large boulders from the spring run on October 26, 2010, to provide improved manatee access to the Springs habitat. Today, the spring run provides the only in-water entrance to the Springs. The run measures approximately 165 feet in length, 5 feet wide at the narrowest point, and 18 feet wide at the widest point, at mid-tide.

Between 1960 and 1985, much of the area around the Springs was cleared of native vegetation, and a large borrow pond, currently known as Lake Linda, was excavated to obtain fill material needed to raise ground elevations for future development. A residential development was planned and permitted for construction in 2008, but the property owners ultimately agreed to sell the parcel surrounding the Springs to a consortium of public agencies for environmental purposes.

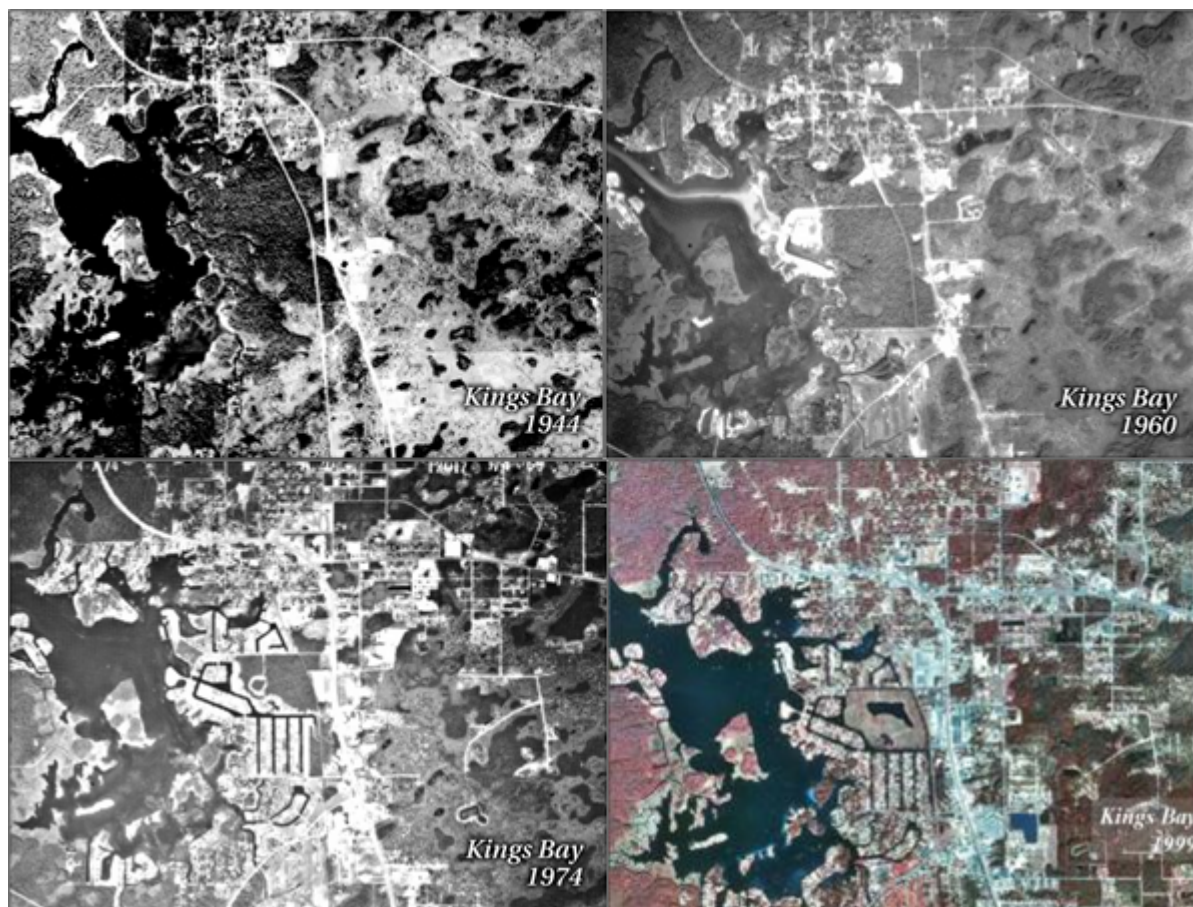


Figure 3. Environmental changes in and around Three Sisters Springs 1944-1999

The second-order springs themselves comprise a complex of three “lobes” aligned on a northwest-southeast axis, with an approximate total length of 250 feet. Each lobe of the spring complex contains spring vents. The northwestern lobe (Little Sister) of the trio is centered at $28^{\circ}53'19.46''\text{N}$, $82^{\circ}35'21.37''\text{W}$ and contains approximately twelve circular vents, with dimensions ranging between 1 foot and 0.5-foot. Water depths are estimated at 8-10 feet deep and discharge volumes were low to moderate. The middle lobe (Deep Sister) of the trio is centered at $28^{\circ}53'18.70''\text{N}$, $82^{\circ}35'20.87''\text{W}$ and contains a large kidney-shaped vent approximately 20 feet long by 5 feet wide filled with debris, including tree limbs and vegetation.

Water depths within this lobe are approximately 20 feet deep and discharge volumes are high. The southeastern lobe (Pretty Sister) of the trio is centered at 28°53'18.14"N, 82°35'20.16"W and contains approximately six vents, with dimensions ranging between 2.1 feet x 2.1 feet to 0.4-foot x 0.4-foot (Figure 4). Water depths were estimated at approximately 15 to 20 feet deep and discharge volumes were high (SWFWMD 2009). Soils surrounding the Springs are dominated by Matlacha soils, which are disturbed soils produced from dredging and grading work. The bottoms of the Springs and spring run are generally sand or exposed limestone; water clarity is generally good to excellent varying with tide and manatee numbers in the Springs (SWFWMD 2009).



Figure 4. Area examined in this EA; three lobes of Three Sisters Springs, spring banks, the existing boardwalk with observation platforms, and the entrance or spring run.

Currently, the area around the Springs is comprised of open space with scattered trees. A hardwood fringe provides a buffer around the warm water springheads and run. Additionally, a narrow riparian zone, 1 foot to 40 feet wide, characterizes the perimeter of the Springs. A site inspection identified what appears to be levees, fill material, and sporadic boulders within the west-southwest riparian zone of the Springs. Evidence from historical aerial photographs and current conditions suggests that the Springs, inter-pool connections, spring run, and riparian corridor may have been directly altered by the previous landowner during land use conversion for property development in the 1970s (Herrington 2012). Under this scenario, the riparian vegetation was removed, the Springs and inter-pool connections were widened, and fill was placed atop the banks and the riparian zone. All of this occurred at the same time that the surrounding wetlands were filled during the construction of Lake Linda (Herrington 2012). Changes in hydrology resulting from filling the surrounding wetlands may have resulted in decreased water retention and increased surface and subsurface flow to the Springs and its banks, causing further bank instability given that the root structures are perched relative to the toe of the

River NWR staff, manatee use in the ID1 sanctuary reached a peak of 54 animals during the 2004-2005 winter manatee season, with one additional manatee in the canal outside the sanctuary (J. Kleen 2015, pers. comm.). In 2006, manatee use in ID1 peaked at 57, with an additional 14 in the canal outside the sanctuary (J. Kleen 2015, pers. comm.). Manatees were documented resting inside the Springs on the January 2007 aerial survey, with 23 animals recorded in the middle lobe and 34 in the east lobe. An additional 35 manatees were recorded in ID1 and five in the canal (J. Kleen 2015, pers. comm.). In 2008, small numbers of manatees were documented at the Springs; on January 9, 2008, 39 manatees were recorded in ID1, with an additional ten in the canal (J. Kleen 2015, pers. comm.). In November 2008, 35 manatees were recorded in ID1, with 24 in the canal. On the ground observations within the Springs confirmed the aerial observations in the area. From November 2006 to March 2009, ground count observations reported no more than 60 manatees using the interior of the Springs (I. Vicente 2015, pers. comm.). These observations came from the dive tour operator SUP holders, in-water counts by Refuge staff, and several researchers from U.S. Geological Survey (USGS) (I. Vicente 2015, pers. comm.; R. Bonde 2015, pers. comm.; S. Butler 2015, pers. comm.; C. Beck 2015, pers. comm.; J. Reid 2015, pers. comm.).

By December 23, 2009, with falling air temperatures and subsequent falling Gulf water temperatures, numbers of manatees inside the Springs rose – 36 in the east spring, 35 in the middle spring, and one in the west spring. An additional 44 were recorded in ID1 and 32 in the canal on the same date. In October 2010, 20 large boulders were removed from the spring run entrance to the Springs to allow manatees' access to the warm water habitat during lower tides. The following winter, an extreme cold weather event (coldest temperatures recorded in 100 plus years) occurred in Citrus County in January 2010, with the lowest Gulf water temperature recorded on January 9, 2010 at Aripeka, Florida, of 40° F (Citrus County Chronicle 2010). These low temperatures caused manatee numbers to increase dramatically at the Springs as the animals sought to thermoregulate. On January 20, 2010, 25 manatees were recorded in the middle spring, 25 in the east spring, and 111 in ID1 and 91 in the canal on an outgoing tide (J. Kleen 2015, pers. comm.). On February 3, 2010, 12 manatees were recorded in the east spring, 108 in ID1 and 87 in the canal on an outgoing tide (J. Kleen 2015, pers. comm.). On February 17, 2010, 52 manatees were recorded in the middle spring, with 108 manatees in ID1 and 71 in the canal, also on an outgoing tide (J. Kleen 2015, pers. comm.). Ground counts during this cold weather event recorded over 150 manatees using the interior of the Springs on high tides (I. Vicente 2015, pers. comm.) Many manatees did not leave the Springs for three weeks, regardless of low or high tides, as the Gulf water temperature remained below 60° F.; during 11 of those days, the temperature was below 50° F (I. Vicente 2015, pers. comm., J. Kleen 2015, pers. comm.).

Following the removal of the boulders blocking the spring run and during another cold weather event in December 2010, over 200 manatees were recorded by ground counts inside the Springs (I. Vicente 2015, pers. comm.). This cold weather event was not as severe as the winter of 2009 and yet approximately 250 manatees were counted from the boardwalk surrounding the Springs during the winter of 2010-2011 (I. Vicente 2015, pers. comm.)

During the 2010-11 winter season, manatee numbers continued to rise in the Springs area. On a low, outgoing tide on December 23, 2010, only 11 manatees were counted in the middle spring and four in the east spring. The ID1 sanctuary numbers totaled 158, with 99 more manatees in the canal outside the sanctuary. By January 19, 2011 on a low tide, 192 manatees were counted inside ID1 with 39 in the canal outside the sanctuary. On January 24, 2011, on a high tide, nine manatees were counted in the middle spring, 28 in the east spring, 152 in ID1, and 32 in the

canal. The winters of 2011-2012, 2012-2013, 2013-2014, continued the same trend with increasing numbers of manatees using the Springs on a high tide.

During the 2014-2015 winter manatee season, data were collected at the Springs to document human/manatee interactions and manatee use within the Springs and spring run for 30 days from December 10-January 31, sunrise to sunset. Information collected from the boardwalk surrounding the Springs included weather; tidal stage; air, bay, and Gulf water temperatures; and the number of manatees, swimmers, and paddlecraft, including the time of entry/departure. Additional data included a boardwalk questionnaire to assess the quality of the visitor's experience. This research is being utilized in making management decisions for in-water wildlife viewing and management at the Springs. This research documented up to 446 manatees resting in the Springs during high tides when Gulf water temperatures were below 60°F (Figure 6) (Wolfe and Syverson 2015). The numbers of manatees documented during the 2014-15 season were higher than previously estimated, indicating that more manatees may be resting and nursing in the Springs during winter months.

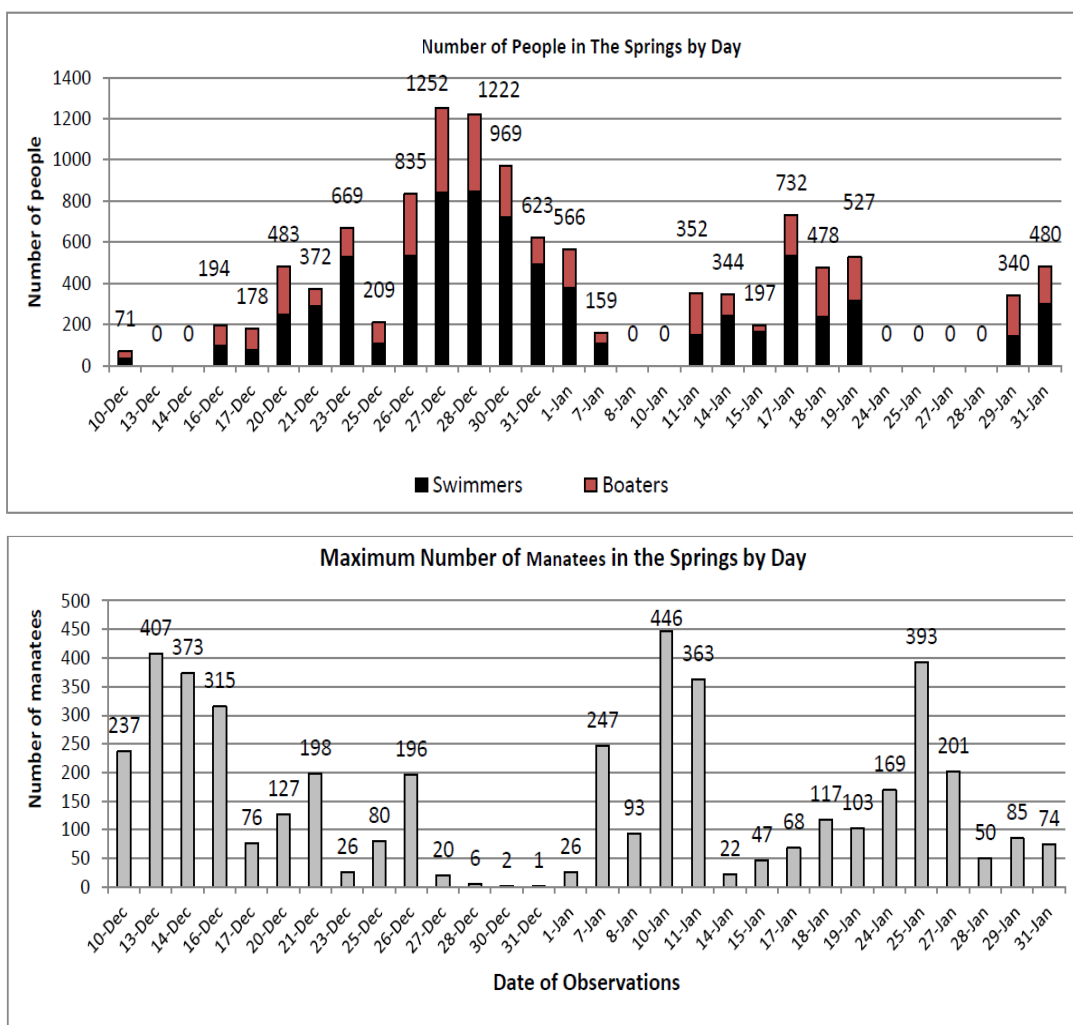


Figure 6. Peak Springs' manatee (446) and visitor (1252) numbers recorded, 2014-15.

1.2 Purpose and Need

Consistent with the goals of the Service's Florida Manatee Recovery Plan (USFWS 2001) and legal framework (Section 1.2.1 below) – agreements and plan with the City of Crystal River, the ESA, MMPA, as well as the Crystal River NWR purposes summarized below – the purpose and need is to minimize the likelihood of take of manatees from otherwise lawful activities and minimize human interactions in a sensitive wintering habitat.

This EA evaluates the proposed management actions in the context of requirements identified in the Declaration of Restrictive Covenants; the Management Agreement for Certain Lands Located Within the City of Crystal River, Citrus County, State of Florida; the Three Sisters Springs Project Management Plan; and purposes identified in the creation of the Crystal River NWR, as summarized below.

With the trend of increasing human visitation to Kings Bay, yearly, there is a need to evaluate human and manatee interactions within the Springs to determine management actions for the future. For example, visitor numbers have nearly doubled since 2010, and from January 2014 to December 2014, a total of 136,738 people visited Crystal River NWR waters according to the special use permit holder counts (Figure 7). Of these visitors, an estimated 97 percent entered the Springs (I. Vicente 2015, Pers. comm.). In 2014, the guided commercial use of the Springs between November and April totaled 53,520 visitors; and November - April rental boat customers, who also frequent the Springs, totaled 21,699 (Commercial SUP Visitors Reports 2014 for Crystal River NWR). Without appropriate management actions, this volume of visitation in the confined Springs has the potential to disturb manatees' natural movements between the Springs as their resting and nursing habitat and their foraging habitats outside of the Springs.

Of particular concern is the spring run area, or in-water entrance to the Springs. At the narrowest point, at mid-tide, the spring run is approximately 5 feet wide. These limited dimensions create a bottleneck for manatees, snorkelers, and paddlecraft that may cause a safety hazard to visitors, while creating conditions under which the existing Twelve Prohibitions (see Section 1.3.2.1) have a high likelihood of being violated. Additionally, manatee ingress and egress is blocked on many occasions due to the high volume of snorkelers and boaters in the spring run. Manatees have also been documented resting in the spring run. On one of the busiest days recorded, total passages by manatees, snorkelers, and paddlecraft through the spring run were 2,325 or one passage every 15.4 seconds. The same day, 842 snorkelers and 304 paddlecraft entered the Springs (Wolfe and Syverson 2015, *in prep.*). Figure 8 shows the average number of passages in the spring run (manatees, paddlecraft, and/or snorkelers/swimmers) over a one-month observation period during the 2014-2015 manatee season. The Refuge has collected sufficient monitoring and inventory data, combined with observational information, to substantiate that manatee behavior has the potential to be impacted by the volume of visitors both in the spring run and the Springs. Without adequate measures implemented to address recovery, the crowding by visitors in the spring run could compromise manatee natural behaviors.

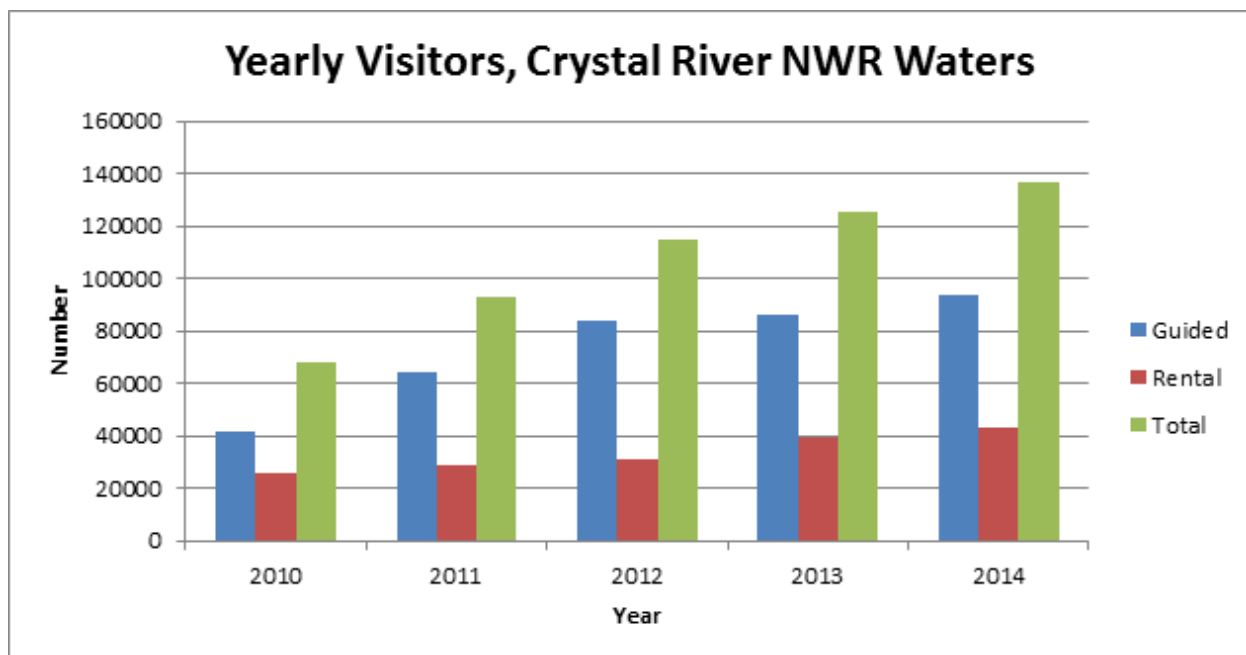


Figure 7. Yearly visitor numbers – January 1 to December 31 – in Kings Spring and Three Sisters Springs (Commercial SUP Visitors Reports 2010-2014 for Crystal River NWR)



Figure 8. One month of observations during the 2014-2015 manatee season revealed that crowding and congestion in the spring run by paddlecraft, snorkelers, and manatees may cause a safety hazard to visitors and potentially alter or impede manatee movements between habitats (Wolfe and Syverson 2015).

Additionally, FWS law enforcement in and around Kings Bay notes an increase in warnings to visitors regarding the existing twelve prohibitions (see Section 1.3.2.1), as well as an increase in actual citations between 2004 and 2014 (Table 1).

Year	Warnings	Citations	Management Change or Staffing Limitations
2004	4	2	-
2005	26	4	-
2006	35	4	-
2007	7	3	1 duty officer only
2008	7	3	1 duty officer only
2009	7	4	2 officers in training
2010	36	3	-
2011	12	16	-
2012	4	34	Manatee Protection Rule, Kings Bay, established 03/2012
2013	136	22	More efficient warnings reporting system implemented
2014	377	21	More efficient warnings reporting system implemented
Note: Warnings include instances where the officer observes a person or group violating a prohibition, makes contact with that person or group, and provides corrective direction.			

Table 1. FWS law enforcement warnings, citations, and manatee incidents, 2004-2014

The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), allows national wildlife refuges to provide for wildlife-dependent recreation by visitors, but requires national wildlife refuges to manage for the conservation of fish, wildlife, and habitat for present and future generations of Americans. The Crystal River NWR has been monitoring and documenting the recreational use of the 1.5-acre Springs and has determined that the numbers and types of recreational uses and visitors to the area may be potentially affecting the natural movements, behaviors, and interactions of the endangered Florida manatee.

Therefore, the Service has determined that in order to meet its legal mandates under federal law and fulfill its management agreement with owners of the Springs property, the refuge must propose management actions to limit the numbers and types of in-water visitors when manatees are present in the springs.

Recommendations for changes to manatee viewing would only apply to the three springheads located at the Springs and associated spring run during manatee season. Although manatee season is typically defined as November 15 to March 31, in the past, major cold fronts have reached Florida prior to and after these prescribed dates. Given the potential effects of climate change, the Service is applying a precautionary approach with regard to seasonal definitions, to minimize the potential effects of combined cold stress syndrome with potential disturbance on endangered Florida manatees. A precautionary approach is based on the recognition that a false prediction that a human activity will not result in environmental harm will typically be more harmful to society than a false prediction that it will result in environmental harm (IUCN 2007). Under such conditions, manatee season may be extended to November 1 through April 15.

Finally, the Springs themselves are suffering from bank erosion, causing tree falls, loss of tree islands, and overall habitat degradation for manatees. In some cases, nearly the entire rooting structure is exposed, with little or no connection to the banks; some with severely undercut banks that have extreme bank angles extending >4 feet under the bank. Other areas, particularly along the southern reach of the Springs, show evidence of historical tree and root collapse and subsequent removal. Manatees are also observed to browse along the banks, likely degrading

bank stability (Herrington 2012). Therefore, shoreline engineering for bank stabilization is needed to safeguard the very integrity of this vital manatee winter habitat.

1.2.1 Refuge Legal Framework

Legal Authorities and Mandates

The management of individual National Wildlife Refuge System units is dictated, in large part, by the legislation, executive order, or administrative action that creates the unit. The refuge purpose(s) reflected in enabling legislation, executive orders, and administrative actions may range from narrow to broad.

Crystal River NWR was administratively authorized by the Director of the Service on January 10, 1983, to conserve threatened and endangered species, specifically focusing on the West Indian manatee (*Trichechus manatus*) and more specifically the Florida subspecies (*Trichechus manatus latirostris*).

“...to conserve (A) fish or wildlife which are listed as endangered species or threatened species...” 16 U.S.C. 1534 (Endangered Species Act of 1973).

Secondary purposes also apply to Crystal River NWR, as listed:

... suitable for...(1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ...” 16 U.S.C. 460k-1 “... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ...” 16 U.S.C. 460k-2 (Refuge Recreation Act, 16 U.S.C. 460k-460k-4, as amended).

... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions...” 16 U.S.C. 3901 (B) 100 Stat.3583 (Emergency Wetlands Resources Act of 1986).

The objectives for Crystal River NWR include:

- 1) To provide habitat and protection for the Florida manatee consistent with the requirements of the ESA, MMPA, and the Florida Manatee Sanctuary Act.
- 2) To foster a sense of public commitment to and understanding of the plight of the manatee and its need for protection by providing opportunities for environmental education, interpretation, and sustainable wildlife-dependent recreation.
- 3) To support the Service's commitment to implement and carry out the objectives of the nationwide Manatee Recovery Plan.
- 4) To provide habitat for the natural diversity of wildlife species.

Operation and management of national wildlife refuges are also influenced by a wide array of other laws, treaties, and executive orders pertaining to the conservation and protection of natural

and cultural resources. Among the most important orders and laws affecting the operation and management of refuges are Executive Order 12996, the Improvement Act, the Refuge Recreation Act, the ESA, MMPA, , and the Fish and Wildlife Act. Other key considerations are:

The National Wildlife Refuge System Administration Act serves as the "organic act" for the National Wildlife Refuge System. The National Wildlife Refuge System Administration Act, as amended by the Improvement Act, consolidated the various categories of lands administered by the Secretary of the Interior (Secretary) through the Service into a single National Wildlife Refuge System (Refuge System). The Improvement Act establishes a unifying mission for the Refuge System, a process for determining compatible uses of refuges, and a requirement for preparing comprehensive conservation plans. The Improvement Act states that ***first and foremost that the mission of the National Wildlife Refuge System be focused singularly on wildlife conservation*** (emphasis added). The Improvement Act identified six priority wildlife-dependent recreation uses, clarified the Secretary's authority to accept donations of money for land acquisition, and placed restrictions on the transfer, exchange, or other disposal of lands within the Refuge System. Most importantly, the Improvement Act reinforces and expands the "compatibility standard" of the Refuge Recreation Act. The Improvement Act authorizes the Secretary, under such regulations as he may prescribe, to ***"permit the use of any area within the System for any purpose, including but not limited to hunting, fishing, public recreation and accommodations, and access whenever he determines that such uses are compatible with the major purposes for which such areas were established"*** (emphasis added).

Refuge Recreation Act or "the Recreation Act" requires that any recreational use on areas of the Refuge System be "compatible" with the primary purpose(s) for which the area was acquired or established. The Recreation Act also requires that sufficient funding be available for the development, operation, and maintenance of recreational uses that are not directly related to the area's primary purpose(s).

The **Endangered Species Act of 1973** (ESA), as amended, did not specifically address the Refuge System but it does directly affect management activities within the Refuge System. The ESA directed federal agencies to take actions that would further the purposes of the ESA and to ensure that actions they carry out, authorize, or fund do not jeopardize endangered species or their critical habitat. The ESA also provides authority for land acquisition. Conservation of threatened and endangered species has become a major objective of both land acquisition and refuge management programs.

The **Marine Mammal Protection Act of 1972** does not specifically address the Refuge System, but it does directly affect management activities within the Refuge System. The Marine Mammal Protection Act (MMPA) was the first legislation that called for an ecosystem approach to natural resources management and conservation. The MMPA prohibits the 'take' (i.e., hunting, killing, capture, or harassment) of marine mammals, and enacts a moratorium on the import, export, and sale of marine mammal parts and products. The MMPA established federal responsibility to conserve marine mammals with management vested in the Department of the Interior for sea otters, walruses, polar bears, dugongs, and manatees. Authority to manage marine mammals was divided between the Department of the Interior (delegated to FWS) and the Department of Commerce (delegated to the National Marine Fisheries Service [NMFS] within the National Oceanic and Atmospheric Administration [NOAA]). A third Federal agency, the Marine Mammal Commission [MMC], was later established to review and make recommendations on

the policies and actions of the Service and NOAA-NMFS related to their implementation of the MMPA.

50 CFR 25.21(e) states with respect to the Springs, *“In the event of a threat or emergency endangering the health and safety of the public or property or to protect the resources of the area, the Refuge Manager may close or curtail refuge uses of all or any part of an opened area to public access and use in accordance with the provisions in 25.31, without advance notice”* (emphasis added).

50 CFR 17.108 – The Springs was included in the Kings Bay Manatee Protection Area expanded temporary no-entry areas in 2011, which allows the Service to restrict waterborne activities including, but not limited to, swimming, diving (including skin and scuba diving), snorkeling, water skiing, surfing, fishing, and the use of water vehicles (including boats, personal watercraft, and other vehicles used to move across or underneath the water’s surface).

Agreements and Plans

The **Declaration of Restrictive Covenants** is an agreement entered into between the Florida Communities Trust, a non-regulatory agency within the Florida Department of Community Affairs, and the City of Crystal River, a local government of the State of Florida. The intent of the agreement is to impose the terms and conditions on the use of the proceeds of certain bonds and the lands acquired with such proceeds (the Springs). This agreement is necessary to ensure compliance with the applicable Florida law and federal income tax law and to otherwise implement the provisions of Sections 259.105, 259.1051, and Chapter 380, Part III, Florida Statutes. The Declaration of Restrictive Covenants outlines how the Springs is to be managed for conservation, protection, and enhancement of natural and historical resources and for compatible passive, natural resource-based public outdoor recreation, along with other related uses necessary for the accomplishment of this purpose.

Management Agreement for Certain Lands Located Within the City of Crystal River, Citrus County, State of Florida. The Service manages the property under a management agreement with the City of Crystal River and the SWFWMD. The property is 70 percent owned by the city and 30 percent by the SWFWMD. The agreement outlines how Crystal River NWR will manage the Springs for the public purpose of conserving, protecting, and enhancing the natural resources. The Refuge manages the area as an extension of the Refuge in accordance with 1) the Three Sisters Springs Project Management Plan; 2) the National Wildlife Refuge System Administration Act of 1966, as amended by the Improvement Act; 3) other acts of general applicability to the Refuge System; 4) Title 50 of the Code of Federal Regulations (including the Kings Bay Manatee Protection Area Rule); and 5) Florida laws and regulations. Within the authority of the Improvement Act and the Agreement, the Service is directed to keep the Springs open to public recreation, maintaining and sustaining quality visitor experiences while at the same time providing adequate protected areas for manatees, thus balancing the use of manatees and visitors. The agreement lasts for 25 years and allows for two automatic 25-year extensions.

Three Sisters Springs Project Management Plan

In accordance with the terms of the Florida Communities Trust grant, the City of Crystal River has, in conjunction with FWS and SWFWMD, developed this Management Plan to ensure that the project site will be developed in accordance with the Grant Award Agreement and in a manner consistent with the grant application. As explained further herein, this Management Plan

describes the ultimate development of a nature discovery area, a nature trail, at least one picnic pavilion, a fishing dock, and a boardwalk adjacent to the Springs. It further describes the development of two manatee viewing stations adjacent to Magnolia Springs that would allow the public to observe manatees in their habitat, construction of an environmental education center that would focus on manatee protection and watershed restoration, and the creation of a treatment wetland on the site that would treat storm water from adjacent commercial and residential areas prior to such runoff being released into the Kings Bay/Crystal River springs system, thus improving the health of Kings Bay. The project site would be managed for the conservation, protection, and enhancement of natural resources (including manatees), and for outdoor recreation compatible with those goals.

The 57.1-acre Springs property was purchased through a partnership effort in July 2010. This partnership included a Florida Communities Trust grant to the City of Crystal River; funding through Citrus County and the Citrus County Tourist Development Council; private donations from the Felburn Foundation, the Friends of Crystal River NWR Complex, National Wildlife Refuge Association, Save the Manatee Club, environmental organizations, civic clubs, and individuals; Florida Forever funding through the SWFWMD; and federal funding from Congress. Federal (\$3 million) and Felburn Foundation (\$2.7 million) funding was used to retire the water rights for the Springs by purchasing the Consumptive Use Permit. The Service manages the property under a lease agreement with the City of Crystal River and SWFWMD. The property is 70 percent owned by the City of Crystal River and 30 percent by the SWFWMD. The lease lasts for 25 years and allows for two automatic 25-year extensions. The Refuge manages the area under the Three Sisters Springs Management Agreement (Agreement) with the City of Crystal River and the SWFWMD, which provides for the Service to manage the Springs as an extension of the Refuge in accordance with (1) the Three Sisters Springs Project Management Plan; (2) the Improvement Act; (3) other acts of general applicability to the Refuge System; (4) 50 CFR (including the Kings Bay Manatee Protection Area Rule); and (5) Florida laws and regulations. Within the authority of the Improvement Act and the Agreement, the Service is directed to keep the Springs open to public recreation, maintaining and sustaining quality visitor experiences while at the same time providing adequate protected areas for manatees.

All proposed action alternatives would comply with the above and would be consistent with the Service's Florida Manatee Recovery Plan (USFWS 2001) and the Service's status review of the West Indian manatee (USFWS 2007; Ecological Services review, in prep.). All action alternatives would also be consistent with FWC's Florida Manatee Management Plan (FWC 2007).

1.3 Alternatives

1.3.1 Alternatives Formulation

Development of alternatives for the proposed action in the Springs entailed consideration of four key variables: (1) increasing manatee usage of the Springs; (2) federal regulations prohibiting the take of manatees, including the ESA and MMPA; (3) Improvement Act; and (4) public use and community needs.

Current Manatee Usage of Three Sisters Springs

The Springs provide a primary resting area for the endangered Florida manatees in northwest Florida, a region that supports approximately 17 percent of the entire population of this subspecies. The manatee population in the area surrounding the Springs has steadily been increasing over the past decades, reaching a high of 797 manatees during the winter of 2014-2015. As many as 588 manatees have been recorded using the confined, shallow, warm water springs. Additionally, large numbers of recreational snorkelers and paddlecraft have also been recorded using the same confined, shallow, warm water in the Springs that is manatee habitat; their number has increased to over 130,000 per season (Commercial SUP Visitors Reports 2014, for Crystal River NWR).

Federal Regulations Prohibiting the Take of Manatees

The Service defines takings, including harassment, in its implementing regulations for both the ESA and the MMPA (50 CFR 17.3 and 50 CFR 18.3). These regulations prohibit the take of listed species, including manatees. Federal and state law enforcement officers enforce the current ESA and MMPA regulations, citing and prosecuting violators who engage in activities known to take manatees, including violators who harass or disturb manatees while engaged in viewing activities.

Pursuant to the Service's implementing regulations under the ESA (50 CFR 17.3), harassment includes any intentional or negligent acts or omissions that create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns. Normal behaviors include, but are not limited to, breeding, feeding, or sheltering. Within the Springs, common manatee behaviors include feeding of young by nursing, and sheltering to rest in the warm waters. In addition to the statutory definitions per Section 3 of the MMPA for "take" (3(13)) and "harassment" (3(18)), take is further defined in regulations at 50 CFR 18.3 to include, without limitation, any of the following: the collection of dead animals or parts thereof; the restraint or detention of a marine mammal, no matter how temporary; tagging a marine mammal; or the negligent or intentional operation of an aircraft or vessel, or the doing of any other negligent or intentional act which results in the disturbing or molesting of a marine mammal.

1.3.2 Alternatives Considered

Beyond the No Action Alternative, two alternatives (Alternatives B and C) were considered for managing sustainable wildlife viewing in the face of increasing human recreational uses and manatee habitat needs. They are compatible with legal frameworks (see Section 1.2.1) for managing the 1.5 acres of warm water springs located on the Springs property, including the agreements and plan with the City of Crystal River and SWFWMD, and the Crystal River NWR establishing purposes.

1.3.2.1 Alternative A - No Action

The No Action Alternative maintains existing management measures within the Springs and the spring run during manatee season, but does not provide any additional measures. Existing management measures and prohibitions in the Springs include:

- Enforcing the current twelve prohibitions. These are:
 1. No chasing or pursuing of a manatee(s)

2. No cornering or surrounding of a manatee(s)
 3. No poking, prodding, or stabbing of a manatee(s)
 4. No feeding of a manatee(s)
 5. No riding or holding of a manatee(s)
 6. No grabbing or pinching of a manatee(s)
 7. No disturbing or touching of a resting manatee(s)
 8. No diving on a resting or feeding manatee(s)
 9. No separating of a manatee(s) mother and calf(s)
 10. No actively engaging of a tagged manatee(s) or associated gear
 11. No entering of manatee sanctuaries
 12. No standing on a manatee(s)
- Continuing to promote public and visitor education regarding ‘Passive Observation’ via ‘Manatee Manners’ outreach materials;
 - Continuing to provide wildlife and nature interpretation and public education via seasonal, professional nature interpreters on the boardwalk;
 - Continuing to prohibit entering the Springs between official sunset and official sunrise;
 - Continuing to prohibit scuba diving and fishing including, but not limited to, fishing by hook and line, by cast net, or by spear;
 - Evaluating the Springs on a daily basis, during manatee season, and opening or closing the Springs to in-water, recreational access in response to estimated or actual manatee numbers in/around the Springs and also evaluating key environmental factors (i.e., actual or estimated manatee numbers from counts in the Springs, the spring run, and areas at the mouth of the run, tide heights measured within the Springs, ambient sea water temperatures from Shell Island U.S. Geological Survey weather monitoring station, and ambient water temperatures from the canal entrance to the spring run);
 - Continuing federal and state law enforcement efforts to cite and prosecute disturbance and harassment of manatees under 50 CFR 17.3 and 18.3, the ESA and the MMPA;
 - Continuing to actively engage visitors and the community via outreach and communication partnerships with local stakeholders and institutions in manatee conservation efforts;
 - Supporting SWFWMD’s bioengineering project stabilizing the Springs shoreline to address bank erosion.

The Springs bank stabilization bioengineering project would stabilize vulnerable shorelines from current and future erosion by backfilling undercuts with geotextile bags filled with soil, facilitating root growth of existing vegetation, and stabilizing the undercut shoreline. Large limestone rocks would also be used to reinforce and protect both the geotextile bags and the shoreline from further erosion and undercutting. Bank stabilization would ensure the continued existence of the surrounding vegetation and ensure that the Springs remain habitat for manatees.

Bank stabilization would incorporate bioengineering techniques, providing a biologically appropriate and safe environment for manatees and the visiting public.

1.3.2.2 Alternative B - Provide for enhanced manatee viewing from land only and improve manatee habitat via bank stabilization to limit erosion

This alternative would protect resting and nursing manatees from potential disturbance by closing the Springs to all in-water access during manatee season, while providing enhanced land-based manatee viewing opportunities for visitors. Additionally, this alternative would protect manatee habitat by stabilizing the Springs eroding banks and limiting the threat of epizootic disease transmission by banning pets. Pets may carry communicable diseases that could adversely affect visitors and manatees (Bossart *et al.* 2012).

The following management measures from Alternative A would be included in Alternative B. They are:

- Enforcing the current twelve prohibitions (see page 22);
- Promoting public and visitor education regarding ‘Passive Observation’ via ‘Manatee Manners’ outreach materials;
- Providing wildlife and nature interpretation and public education via seasonal, professional nature interpreters on the boardwalk;
- Continuing federal and state law enforcement efforts to cite and prosecute disturbance and harassment of manatees under 50 CFR 17.3 and 18.3, the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA);
- Continuing to actively engage visitors and the community via outreach and communication partnerships with local stakeholders and institutions in manatee conservation efforts;
- Supporting the Southwest Florida Water Management Districts’ (SWFWMD) bioengineering project stabilizing the Springs shoreline to address bank erosion.

The following additional management measures would be implemented under this alternative:

- Prohibit all in-water access (swimming, snorkeling, paddlecraft, etc.) to the Springs and provide access to the Springs for manatee viewing, nature interpretation, and public education from Americans with Disabilities Act (ADA)-compliant boardwalks and elevated viewing platform(s) only;
- Improve existing boardwalks to comply with ADA and public safety standards for improved views of the Springs, wildlife viewing, and recreational photography. For public safety, the boardwalk would be reengineered with non-slip materials such as composite lumber decking with a high friction coefficient. Additionally, a smooth composite lumber material would be used for a guardrail system;
- Prohibit pets on the boardwalk, shoreline, or in the water at the Springs and the spring run;
- Construct an ADA-compliant elevated viewing platform (Figure 9) to allow for improved views of the Springs, wildlife viewing, and recreational photography, such that:

The current boardwalk around the Springs would be improved to allow for wildlife viewing by mobility-impaired visitors and an improved viewshed for all visitors. By incorporating two elevated observation platforms on the southwestern side of the Springs boardwalk, mobility impaired visitors would have a heightened view to observe manatees in and around Deep Sister spring. The first ADA-compliant observation platform would be approximately 9.5 feet high and 6 feet wide, with a maximum of 1:12 sloping ramp leading from the current boardwalk to the platform. The second platform would be approximately 14 feet high and 12 feet wide, with steps leading up from the ADA-compliant platform. Both of these additional viewing platforms would be below the mid-story tree canopy (approximately 22 feet) and below the over-story tree canopy (approximately 50 feet), thereby maintaining the aesthetics of the site by hiding the platforms from the wider Springs site and from community neighbors.

- Provide additional interpreters on the boardwalk for public education;

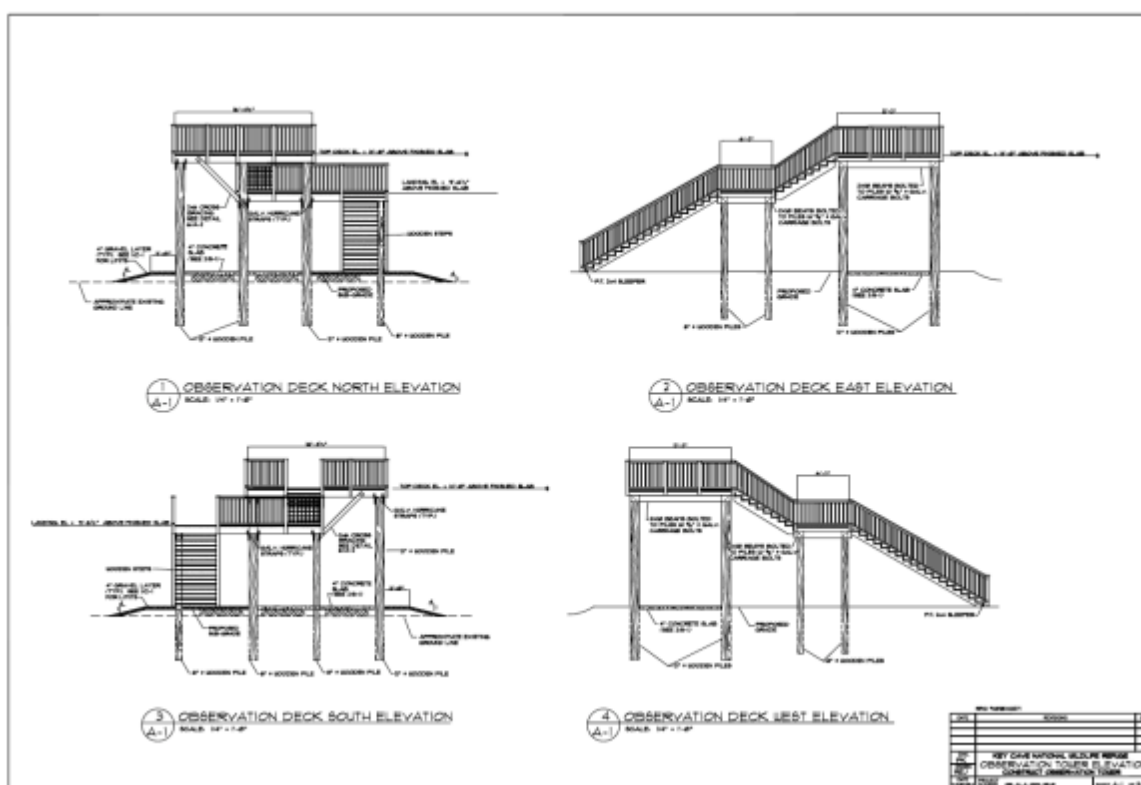


Figure 9. Proposed ADA-compliant elevated viewing platform(s) for the Springs.

1.3.2.3 Alternative C - Proposed

As in Alternative B, Alternative C would protect manatee habitat by stabilizing the Springs eroding banks and by limiting the threat of epizootic disease transmission by restricting pets (See Appendix I, Section 7 Review). Also, as in the previous alternative, Alternative C would provide enhanced land-based wildlife viewing opportunities for visitors. Additionally, this alternative would allow for limited, guided in-water manatee viewing.

The following management measures from Alternative A and B would be included in Alternative C. They are:

- Enforcing the current twelve prohibitions (see page 22);

- Promoting public and visitor education regarding ‘Passive Observation’ via ‘Manatee Manners’ outreach materials;
- Providing wildlife and nature interpretation and public education via seasonal, professional nature interpreters on the boardwalk;
- Prohibiting entrance to the Springs between official sunset and official sunrise;
- Prohibiting scuba diving and fishing including, but not limited to, fishing by hook and line, by cast net, or by spear;
- Continuing federal and state law enforcement efforts to cite and prosecute disturbance and harassment of manatees under 50 CFR 17.3 and 18.3, the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA);
- Continuing to actively engage visitors and the community via outreach and communication partnerships with local stakeholders and institutions in manatee conservation efforts;
- Supporting the Southwest Florida Water Management Districts’ (SWFWMD) bioengineering project stabilizing the Springs shoreline to address bank erosion.
- Improving existing boardwalks to comply with ADA and public safety standards for improved views of the springs, wildlife viewing, and recreational photography;
- Prohibiting pets on the boardwalk, shoreline, and in the water at the Springs and the spring run;
- Constructing an ADA-compliant elevated viewing platform to allow for improved views of the Springs, wildlife-viewing, and recreational photography;
- Providing additional interpreters on the boardwalk for public education;

The following additional management measures would be implemented under this alternative:

- Close all in-water access to the Springs via the narrow spring run, during manatee season, (November 15 to March 31, with designations for closures that may be made prior to November 15 and after March 31 during cold fronts when manatees are present), yearly;
- Provide in-water access to limited numbers of visitors, daily, via fee-paying and limited commercial SUPs (Appendix II) from an ADA-compliant floating dock and ramp attached to the improved boardwalk (Figures 9 and 10), such that:

SUP holders and their clients conducting permitted activities limited to guided snorkeling, guided commercial photography, guided commercial filming, and permitted filming for educational purposes would constitute the entirety of in-water activities in the Springs during manatee season. The Refuge may issue an exception to these activities for management or permitted research purposes after careful review of the proposed actions and their possible impacts on manatees.

The Refuge is proposing to limit the number of permits (SUPs) to five or less, and each permit would place limits on the number of snorkeling clients in the Springs at any one time to four or less per permitted company per allotted time in the Springs, with one FWS-certified guide supervising visitors at a ratio of 4:1.

The reduced number of SUPs to be allotted was estimated by starting with a conservative estimate of the total number of in-water visitors and guides that may be in the Springs at any one time while prioritizing the non-disturbance of resting and nursing manatees. A more specific calculation is provided below.

This initial allowable visitor number was calculated by estimating the total surface area of the open waters of the Springs, between the two closed lobes, and designating approximately $\frac{1}{4}$ surface usage for recreational wildlife viewing activity and $\frac{3}{4}$ for unimpeded manatee use. The open water surface area is estimated at $\frac{1}{3}$ the total surface area or 16,335 square feet with each person at the surface taking up an estimated 144 square feet when allowing for a minimum 6 ft. interaction buffer in a square around each person (i.e. six feet in front, behind and on two sides of each). Given 5 guides and 20 visitors plus two photographers, each with a guide, the total people in the Springs at any given time would be 29. We multiply the number of people by the square feet of buffer area to get a total allotted surface area usage of 4,176 square feet for recreational wildlife viewing. This leaves an aggregate remainder of 12,159 square feet of surface area for manatees to traverse, surface to breath, rest or nurse their calves undisturbed in the open recreational wildlife viewing area.

As manager of the springs, the Service may authorize additional in-water access for research and management purposes on a case-by-case basis.

Given the above calculation, the maximum number of permissible guides at any one time in the Springs is seven. Given that each of those guides may escort up to 4 snorkelers or 1 photographer, a back calculation reveals a total potential for five or less SUPs holders operating in the Springs.

Manatee behavior and human interactions would be monitored and the number of permits and in-water clients may be adjusted based on the Refuge's monitoring program (See Appendix III). The Refuge would evaluate the effect of this number of visitors to the Springs and may adjust accordingly. Applicants would be reminded, prior to issuance of a SUP, that the Refuge would reserve the right to implement emergency closures of the Springs, and that such closures may occur at any time to safeguard the health of manatees or for public safety.

The administrative fee is proposed to be a onetime charge at the time the permit is issued and that charge would range from \$970 to \$1,200 (cost would depend upon number of permits issued) and the in-water access amenity fee is proposed to be \$10 per client per day (one-time entry per client per day). The in-water access amenity fee would not be charged until the official fee package governing this charge is approved. Until this approval is granted, SUP holders would only pay the administrative fee described above. This would be an annual renewable permit. These administrative costs were determined to partially recoup the cost of managing this program which includes one seasonal recreational technician, 8% of the salary for the visitor services specialist to complete training and issue permits, 25% of the salary for a maintenance worker, and cost of maintenance of boardwalk, restrooms, and other visitor amenities.

In order to facilitate manatee ingress and egress through the spring run without disturbance, an ADA-compatible ramp and floating dock would be needed to allow for in-water wildlife viewing in the Springs during manatee season. The ramp would be connected to the northeast side of the improved boardwalk with a maximum of 1:12 slope (approximately 35'x5') and connect to a floating dock along the eastern edge of Deep Sister. A gangway would connect the ramp to a floating dock. The floating dock would be approximately 24' x 8' and consists of a transfer platform with safety launch and hand rail (overhead assist bar) to allow for mobility impaired visitors to access the Springs. The dock would also have ladders on each end to provide ingress and egress by visitors. In order to maintain the aesthetics of the Springs, the ramp and dock

would be made of PVC decking of natural wood color. The aluminum gangway would also be customized to match the natural wood color (Figure 11). All sizes would comply with ADA regulations;

- FWS-certified guides would be required to accompany and supervise visitors during in-water tours and the refuge would standardize guide certification (Appendix IV) for the Springs, during manatee season, such that:

In-water, guided manatee viewing would be available during the hours of 9 a.m. and 4 p.m. daily, except during emergency closures;

All in-water guides would be required to attend an in-water guide training to become FWS-certified (only certified guides would be allowed to accompany clients in the springs). Refuge personnel would lead these training sessions;

Upon entering the property, SUP commercial guides and their snorkeling clients would have access to a commercial operator designated parking lot, an ADA-accessible floating dock located on the northeast side of Deep Sister spring, portable toilets, a staging area complete with limited seating, and a small changing room structure attached to the boardwalk. In addition, snorkeling clients would have access to the boardwalk, trails, and other amenities while under the guidance of the special use permitted commercial operator should a client decide to leave the water before the end of his/her guided experience.

- Require and limit SUPs for the use of any type of flash photography inside the Springs. SUPs for diffused flash photography would be issued for educational or research purposes only, such that:

The refuge proposes to provide access to the Springs to a limited number of commercial photographers and videographers during the manatee viewing season. In-water access would be available for this use from 8 a.m. to 5 p.m. – providing one hour earlier and later access than is provided to the public to allow for optimal light and water clarity conditions for photography – on Monday, Tuesday, Wednesday, and Thursday; and from 10 a.m. to 4 p.m. on Friday, Saturday, and Sunday. Access would be restricted Friday through Sunday for all in-water use to enhance the viewing experience of visitors viewing manatees from the Springs' boardwalk.

To gain access to any Refuge closed areas, whether temporary or permanent, commercial photographers and commercial film companies would be required to apply for an additional Special Use Permit from the Crystal River NWR. In addition, these permit holders would be required to be accompanied by a USFWS certified in-water guide (with current training and in good standing). The guide would be required to provide a complete orientation and would help ensure that photographic activities would not disturb resting or nursing manatees.

The number of commercial photographer and commercial videographer permit holders in the Springs at any one time would be limited to a number of two or less (the refuge would reserve the right to adjust these numbers depending on monitoring results).

Due to the limited number of permits available for this activity, the refuge is proposing the implementation of a lottery style system (Appendix V), which would require commercial photographers and filming companies/videographers to submit an application, during the open application season, for the privilege of operating in the Springs. Permits, using current fee structures, (Appendix V) would be issued for a one week period maximum and applicants would be able to request a maximum of two weeks per viewing season, except during the month of January (peak photographing and filming season) when applicants would be limited to a one week block, maximum.

- Amend the SUP conditions for commercial wildlife observation guides using the Springs to require the following specific stipulations: a City of Crystal River business license or exemption letter and in-water insurance for their clients;
- Close two lobes (Pretty Sister and Little Sister) to in-water access, as necessary, during manatee season, and as needed in response to key environmental factors (i.e., actual or estimated manatee numbers from counts in the Springs, the spring run, and areas at the mouth of the run, tide heights measured within the Springs, ambient sea water temperatures from Shell Island USGS weather monitoring station, and ambient water temperatures from the canal entrance to the spring run) or at the discretion of refuge management (Figure 10);
- Institute a standard of conduct (Appendix VI) for SUP holders, guides, clients, and in-water visitors that supports and promotes responsible, sustainable wildlife-viewing and ecotourism;

Figure 10. Alternative C - Proposed preliminary plan for ADA-compliant ramp, floating dock, elevated viewing platform(s), spring run, and lobe closures during manatee season

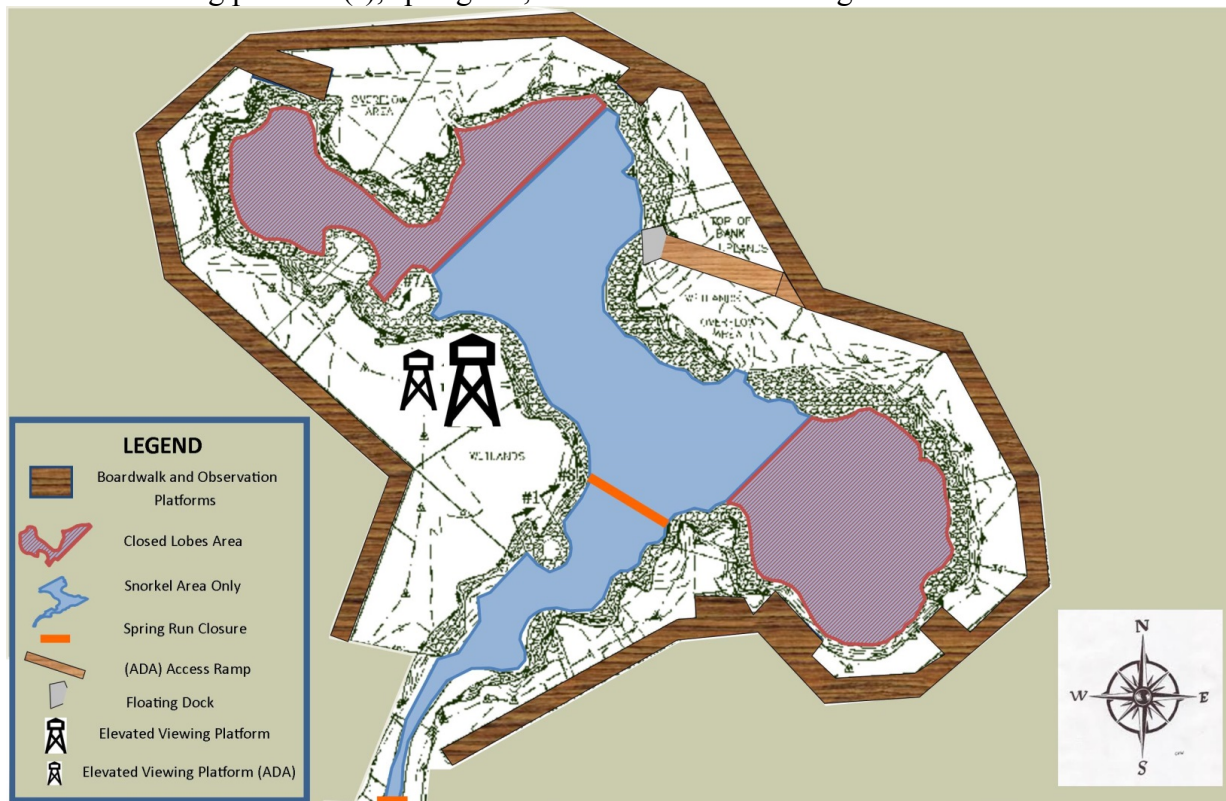
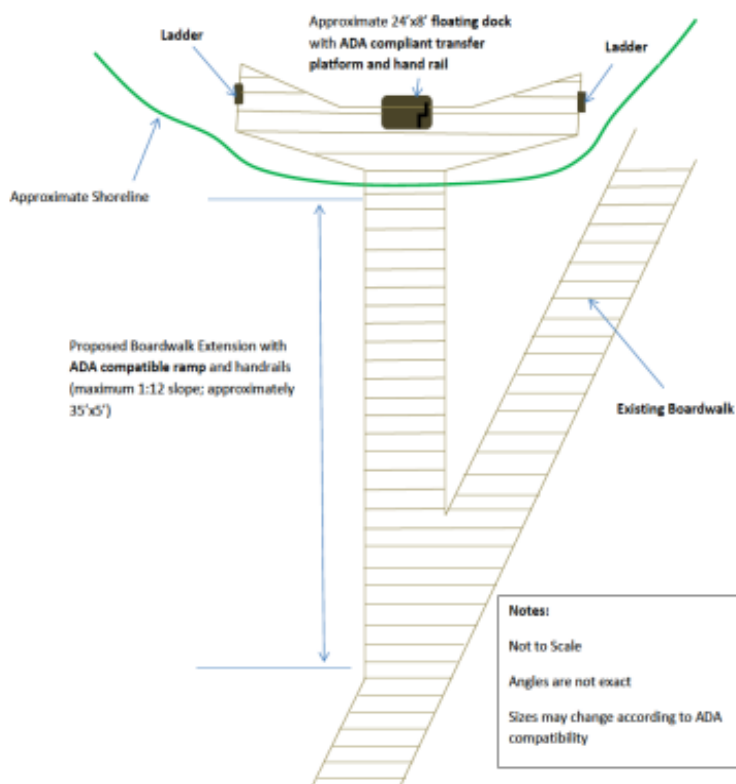


Figure 11. Concept for proposed ADA-compliant ramp and floating dock



1.3.3 Comparison of Alternatives

The relative effects of each of the alternatives, including the No Action alternative, on existing management measures are summarized in Table 2.

Table 2. Comparison of Alternatives

Existing Measures*	Alternative A	Alternative B	Alternative C
Public access during manatee season	No change	Change	Change
Commercial special use permits	No change	Change	Change
Paddlecraft permitted during manatee season	No change	Change	Change
Photography rules and permits	No change	Change	Change
Pets allowed in/around the Springs	No change	Change	Change
Interpretation/public information	No change	Change	Change
Manatee disturbance policy/guidance	No change	Change	Change
Habitat improvements	Change	Change	Change

*Existing management measures do not include measures instituted solely for the 2014-2015 manatee season (USFWS 2015. Final Emergency EA for Manatee Wildlife Viewing, Three Sisters Springs, Crystal River, Florida)

Alternative A: No action; maintain existing management measures and habitat improvements via bank stabilization.

Alternative B: No in-water access or activity during manatee season, improved land-based manatee viewing, and habitat improvements via bank stabilization.

Alternative C: Proposed; limited, guided in-water manatee viewing, improved land-based manatee viewing, and habitat improvements via bank stabilization.

Chapter 2: Affected Environment and Environmental Consequences

2.1 Affected Environment

2.1.1 Human Environment

The Springs is a confined spring basin that provides visitors with some of the clearest water in Kings Bay. It is also the only springs in Kings Bay that is entirely surrounded by native hardwood vegetation, making it the most appealing and naturally aesthetic of all the springs in Kings Bay. The Springs is also the most visited springs complex in Citrus County by snorkelers, paddlers, and land-based visitors, and the most visited springs by commercial tour operators and outfitters in Citrus County, year-round. Currently, the Springs are collectively the only confined, clear-water spring site where people are allowed to recreate, in-water, with manatees during the winter months. All confined springs under state ownership/management in Florida (Ellie Schiller Homosassa Springs Wildlife State Park, Manatee Springs State Park, and Blue Springs State Park) are closed to public, in-water access during the winter when manatees are present.

A suite of recreational and commercial activities associated with the Springs, during the winter, contributes to the local economy. Recreational activities known to occur in the Springs include paddlecraft recreation (kayak, paddleboard, and canoe) and snorkeling; wildlife-dependent activities in the Springs include guided ecotourism, manatee viewing, wildlife photography, and nature interpretation. Commercial activities include guided snorkeling tours, guided paddlecraft tours, commercial photography and filming, and summer commercial scuba diving and instructing. A total of 27 local dive shops/tour operators conduct commercial guided snorkeling operations at the Springs year-round, while another ten outfitter companies rent paddlecraft to visitors or guide visitors in paddlecrafts year-round. A total of 136,738 year-round visitors were reported in 2014 by these 37 tour operators, all under a commercial SUP issued by the Service. The guided commercial uses of the Springs by the 37 commercial SUP holders are higher during tourist season, November 2013 – April 2014 winter months (53,520 visitors reported) compared to the May 2014 – October 2014 summer months (38,688 visitors reported). Boat rental customer totals are almost identical between summer months (21,846) and winter months (21,699). The ratio of the 2014 guided to rental visitors (customers) is 2:1 (93,552 to 43,186 visitors).

The non-commercial recreational uses of the Springs by local, non-tourists consist of different dynamics from the commercial customers, who mainly consist of tourists. More than 125,000 non-commercial visitors (locals) are estimated to use the Springs year-round. The vast majority, over 90,000 of those local visitors, uses the Springs in the summer months (May – October), compared to approximately 30,000 local visitors that use the Springs during the winter months (November – April) (Commercial SUP Visitors Reports for Crystal River NWR, 2014).

Collectively, the tourist and non-tourist visitors use the Springs for different purposes in the winter months versus the summer months. Between May and October, most visitors use the Springs to swim recreationally (without snorkel gear), while a minority of visitors are guided visitors who use snorkel gear and wetsuits (USFWS Public Use Survey Study 2009 – 2014). Most summer visitors in private, guided, and rental paddlecraft exit their vessels to swim in the Springs. Most winter visitors in private, guided, and rental paddlecraft do not exit their vessels to swim in the Springs. The vast majority of visitors (swimmers and paddlers) in the Springs between May and October are unguided, while the vast majority of visitors (swimmers and paddlers) in the Springs between November and April are guided (USFWS Public Use Survey

Study 2009 – 2014). Currently, some visitors accessing the Springs via paddlecraft bring pets, especially dogs, into the Springs.

An average of ten film crews and 30 professional photographers apply for permits yearly to film/photograph manatees underwater, in the Springs. The film crews consist of national and international television media corporations, typically working on documentary films about manatees and the Springs. Professional photographers applying for permits mainly consist of freelancers, either working under a contract for print or electronic media including magazines, newspapers, blogs, social media, and websites, or looking to sell their photos individually or to stock agencies (Commercial SUP Visitors Reports 2013 and 2014 for Crystal River NWR).

2.1.2 Biological Environment

The warm water springs located at the Springs have been classified by the State of Florida as a second-order spring system, discharging from 10 to 100 cubic feet of water per second, with three primary spring boils with interconnected pools. The springheads are situated in a small, entirely confined area. The three springheads and interconnected pools are less than 1.5 acres in size, have an average depth of 6 feet, and are completely surrounded by a vegetated shoreline. Access to the Springs is through a narrow, 5-foot-wide, 165-foot-long water outfall or spring run. The spring run discharges into a dredged, residential canal system with leads into Kings Bay and eventually to Crystal River that flows into the Gulf of Mexico (Herrington 2012).

A variety of wildlife species may be found in the Springs and surroundings. A species list for all fish, wildlife, and plants found on Crystal River NWR with known species for the Springs may be found in Appendix VII.

The Florida manatee, Florida sandhill crane (*Grus canadensis pratensis*), Southeastern American kestrel (*Falco sparverius paulus*), and wood stork (*Mycteria americana*) use the site and are species with state or federal status/designations. Endangered and/or threatened species known or likely to occur at the Springs are listed in Table 2.

Table 2. Federal- and state-listed species known or likely to occur in or around the Springs

Table 2: Federal and state listed species known or likely to occur in or around the Springs			
Scientific Name	Common Name	Agency Status	
		FFWCC	FWS/NMFS
Mammals			
<i>Trichechus manatus latirostris</i>	Florida Manatee	FE	E
Birds			
<i>Egretta caerulea</i>	Little Blue Heron	SSC	-
<i>Egretta rufescens</i>	Reddish Egret	SSC	-
<i>Egretta thula</i>	Snowy Egret	SSC	-
<i>Egretta tricolor</i>	Tricolored Heron	SSC	-
<i>Eudocimus albus</i>	White Ibis	SSC	-
<i>Falco sparverius paulus</i>	Southeastern American Kestrel	ST	-
<i>Grus canadensis pratensis</i>	Florida Sandhill Crane	ST	-
<i>Mycteria Americana</i>	Wood Stork	FT	T
<i>Pelecanus occidentalis carolinensis</i>	Eastern Brown Pelican	SSC	-
Reptiles			
<i>Alligator mississippiensis</i>	American Alligator	T(S/A)	FT(S/A)
<i>Drymarchon couperi</i>	Eastern Indigo Snake	FT	T
<i>Macrolemys temmincki</i>	Alligator Snapping Turtle	SSC	-
Federal Designations: E = Endangered, T = Threatened, T(S/A) = listed due to similarity in appearance of a threatened species (American crocodile), C = Candidate, UR = Under Review, SC = Species of Concern			
State Designations (Florida Fish and Wildlife Conservation Commission 2013): FE = Federally Endangered, FT = Federally Threatened, T(S/A) = Threatened b/c Similarity of Appearance, ST = State Threatened, SSC = State Species of Special Concern			

Vegetation in the Springs and spring run consists of sparse submerged aquatic vegetation and aquatic algae covering limestone outcroppings. Several trees overhang the pool, in some cases with nearly entire root structure exposed with little or no connection to the pool banks. Tree species surrounding the Springs include red maple (*Acer rubrum*), black cherry (*Prunus serotina*), sweetgum (*Liquidambar styraciflua*), red cedar (*Juniperus silicicola*), American elm (*Ulmus americana*), sweet bay (*Magnolia virginiana*), and pop ash (*Fraxinus caroliniana*).

Additional species include sugarberry (*Celtis laevigata*), wild coffee (*Psychotria nervosa*), live oak (*Quercus virginiana*), laurel oak (*Quercus laurifolia*), water oak (*Quercus nigra*), and white basswood (*Tilia americana* var. *heterophylla*). Additional trees were planted in 2014 by the Citrus County Chapter of the Florida Native Plant Society and are included in the plant list for the Springs (Appendix VII) (Curtis 2015).

Aquatic species commonly found in the Springs include blue crabs (*Callinectes sapidus*), bluegills (*Lepomis macrochirus*), bowfin (*Amia calva*), largemouth bass (*Micropterus salmoides*), needlefish (*Strongylura* sp.), mangrove snapper (*Lutjanus griseus*), mullet (*Mugil cephalus*), and snapping turtles (*Chelydra serpentina*) (C. Cavanna 2015, pers. comm., J. Kleen 2015, pers. comm.; and T. Phy 2015, pers. comm.).

Bank erosion within the Springs is causing tree falls, loss of tree islands, and overall habitat degradation for manatees. There are several areas where trees that are currently susceptible to collapse overhang the water. As banks erode and trees collapse into the Springs, they take up space needed and used by resting manatees. In some cases, nearly the entire rooting structure is exposed with little or no connection to the banks; some with severely undercut banks that have extreme bank angles extending >4 feet under the bank. Other areas, particularly along the southern reach of the Springs, show evidence of historical tree and root collapse and subsequent removal. Manatees are also observed to rub along the banks, likely degrading bank stability (Herrington 2012).

2.1.3 Cultural Environment

Although Citrus County is rich with Native American and early settlement history, the lands surrounding the Springs, largely due to their predominantly disturbed soils from historical practices, disturbances, and development, have no known cultural resources (R. Kanaski 2015, pers. comm.). The recent Section 106 review for proposed public use infrastructure projects on the uplands adjacent to the Springs did not reveal any recorded historic properties in the general vicinity. The review demonstrated that much of the area had been substantially disturbed by past canal construction and the associated residential development. The potential for intact archaeological sites in the Springs and the surrounding waters is considered to be very low (R. Kanaski 2015, pers. comm.).

Each of the proposed actions, Alternatives A, B, and C, deal with managing human-manatee interactions in the Springs and adjacent waters. The measures proposed involve some ground disturbances or construction and thus may trigger Section 106 of the National Historic Preservation Act and subsequently necessitate consultation with the Florida Division of Cultural Resources, the Seminole Tribe of Florida, the Miccosukee Tribe of Indians of Florida, the Seminole Nation of Oklahoma, the Muscogee (Creek) Nation, and the Poarch Band of Creeks. However, these measures pose no risk to any known historic properties on the Refuge or associated lands and waters.

2.1.4 Physical Environment

The current physical environment, within the scope of this EA, is depicted in Figure 4 (page 10). It is comprised of the Springs basin and banks, spring run, and the surrounding boardwalk. In addition, along the banks are several informational refuge signs. Associated with the immediate

physical environment, but falling outside the scope of this EA, would be a graveled parking lot and temporary bathrooms, both adjacent to the boardwalk, to accommodate visitors.

2.2 Environmental Consequences

This section describes aspects of the environment that may potentially be affected by each of the alternatives.

2.2.1 Alternative A - No Action

2.2.1.1 Effects on Human Environment

This alternative would not directly change existing conditions to the human environment, including human safety, economy, or recreation.

Human Safety/Recreation

Swimmer and paddlecraft interactions would continue to be a human safety concern under this alternative, due to absence of further management action. Additionally, minor safety concerns associated with the boardwalk would also continue to be a concern.

Economic Conditions and Public Access

This alternative would not have any short-term socioeconomic impacts. However, the absence of actions to reduce potential manatee disturbance and potential harassment via crowding from swimmers/snorkelers and paddlecraft, litigation, and other external factors could result in greater restrictions or complete elimination of access to the Springs during manatee season. Such a closure could impact local tour activities in the long term, and therefore, may have an effect on the local economy.

Economic Costs

Refuge administrative costs would not be directly affected.

Environmental Justice

This alternative would not have a disproportionately high adverse effect on minority or low-income populations.

2.2.1.2 Effects on Biological Environment

The current condition of the Springs biological environment, including water quality, vegetative communities and wildlife habitat, may experience long-term impacts under the no action alternative. Specifically, as visitor numbers continue to increase with unlimited access to the Springs, the numbers of resting and nursing manatees that could potentially be disturbed by swimmers and paddlecraft would continue to increase. However, the manatee's physical habitat may improve as a result of the planned bank stabilization project. Without bioengineering of the Springs shoreline, trees collapsing into the Springs may increase the size and water volume of

the Springs by expanding/lengthening the shoreline. The larger the basin and associated volume of water the less warm the overall ambient temperature. Currently, the existing basin size is considered ideal to sustain the 72°F water during colder weather (D. DeWitt 2011, pers. comm.).

Because this alternative does not ban pets, there would be a potential for epizootic disease outbreak that could impact manatees resting and nursing in the Springs. Toxoplasmosis is a rare disease in manatees, but has been recorded. The two previously reported cases consisted of a manatee calf in Florida with central nervous system infection and an adult Antillean manatee from Guyana with lesions in the heart (Brossart 2007). Three reported cases of manatee toxoplasmosis recently occurred in Puerto Rico (Bossart *et. al.* 2012). Since manatees are known to habituate more urbanized areas, they may be exposed to effluents contaminated with pet feces containing the disease-vector oocysts. Therefore, the flow of this terrestrial parasite through the coastal ecosystem and the emergence of disease at the interface between wildlife, domestic animals, and humans are management concerns. Additionally, five types of morbilliviruses have been detected in marine mammals in the United States: canine distemper virus (CDV) and phocine distemper virus (PDV) in seals and sea otters; dolphin morbillivirus (DMV); pilot whale morbillivirus (PWMV); and Longman's beaked whale morbillivirus (LBWMV), which is collectively referred to as cetacean morbillivirus (CMV) in porpoises, dolphins, and whales (U.S. Dept. of Commerce/NOAA 2013). Though the Florida manatee's immune system appears highly developed to protect it against the harsh marine environment, the first viral disease associated with cutaneous papillomatosis was recently described in Florida manatees (Bossart *et al.* 2012).

2.2.1.3 Effects on the Physical Environment

Water Quality and Hydrology

Because this alternative would include supporting SWFWMD's bioengineering project to address bank erosion within the Springs, water quality and hydrology would likely improve, overall, after initial, short-term increases in turbidity during construction. However, increasing numbers of in-water visitors and continued crowding in the Springs would likely increase frequency of high turbidity and low visibility during manatee season over the long-term.

Noise

This alternative would not address high visitor numbers or over-crowding in the Springs. Therefore, current noise levels from these activities would not change. The bioengineering work to address bank stabilization could produce some short-term construction noise.

Aesthetics and Facilities

Throughout February 2015, not a peak visitor month, 162 swimmers/snorkelers and paddlers were randomly surveyed as they exited the Springs. Approximately one quarter of those surveyed responded that what they liked least was overcrowding inside the Springs, suggesting that overcrowding may have degraded the visitors' perceived aesthetics of the site and overall experience (USFWS Seasonal Study, 2015. Crystal River NWR). As the No Action Alternative would not address overcrowding, perceived aesthetic impacts from these activities would likely continue.

The SWFWMD's bioengineering project to address bank erosion via stabilization would have a long-term positive effect on aesthetics. The stabilization project would decrease eroding banks and falling trees and thus the appearance of falling/dead trees. However, initially, to most visitors the installed limestone rocks would not look natural and the bank bioengineering would be evident until the vegetation grows over the new banks. This natural overgrowth is anticipated to happen rapidly given the amount of vegetation along the banks and the temperate climate of the Springs. Therefore, the Springs banks visual change would progress from a current rooted, gnarly, undercut and precipitous shoreline of crags, exposed root, and dying/leaning trees to a stable, vegetated shoreline growing on a stable base of indigenous limestone, returning the site's aesthetics to a more natural appearing and appealing condition.

Because this alternative would preclude any additional construction or alteration of existing facilities, no further aesthetic impacts would be expected.

Summary – Alternative A

Alternative A, the No Action Alternative, would not meet the purpose and need for the proposed action. Given increased numbers of visitors to the Springs during manatee season, this alternative would address neither human safety nor potential manatee disturbance from visitor overcrowding, nor risk of epizootic disease outbreak from pets currently allowed in the Springs.

2.2.2 Alternative B - Provide for enhanced manatee viewing from land only and improve manatee habitat via bank stabilization to limit erosion.

2.2.2.1 Effects on Human Environment

Potential affects to the human environment for this alternative include impacts to (1) human safety/recreation, (2) socioeconomic conditions, (3) recreational and public access to the springs, and (4) environmental justice.

Human Safety/Recreation

Safety concerns at the Springs are centered on the high volume of snorkelers and swimmers recreating among the currently high volume of visitors on paddlecraft. It is common for snorkelers to be accidentally hit on the head by paddlecraft, particularly during high-volume weekends and holidays. Most of these collisions occur at the spring run where snorkelers and paddlecraft are funneled into a 5-foot-wide narrow portion of the spring run where water flow is strongest and can restrict paddling control, sometimes resulting in collisions with swimmers. This alternative would eliminate this safety concern.

The boardwalk would be rebuilt to make it more user-friendly. Currently, the boardwalk can be slippery for visitors when it is wet. The walking surface would be replaced using a composite lumber material with a high friction coefficient such as 'Trex Transend' decking. It is also recommended that a smooth composite lumber material be used as a top board for the guardrail system to prevent visitors from getting splinters. Additionally, an elevated viewing platform, with safety rails, would be added on the southwestern side of the Springs to improve manatee viewing and photography opportunities for the public.

Socioeconomic Conditions

In order to gauge the economic impact of this alternative, both benefits and costs are considered. Potential economic benefits related to this alternative include: increased manatee protection, which may improve the quality of the visitor experience related to manatee viewing from the boardwalk and elevated viewing platform; increased swimmer and paddlecraft safety; improved habitat health; and long-term decreased shoreline maintenance costs. Potential economic costs are related to restriction of visitors to the boardwalk at the Springs. Economic costs consider the number of tour operators and outfitters that would be excluded from providing commercial recreation opportunities inside the Springs and the number of visitors (guided and unguided) that would no longer have access to in-water recreation in the Springs during manatee season (November 15 to March 3, with designations for closures that may be made prior to November 15 and after March 31 during cold fronts when manatees are present).

Economic Benefits

The Service believes this alternative would increase the level of manatee protection in this area. Improved protection for the manatee may result in direct economic benefits by ensuring the continued, local presence of viewable manatees and the continued existence of the manatee viewing industry. An indirect benefit may be noise reduction from decreased crowding in the springs, which may increase property values.

The public's support for manatees and their protection has been examined through contingent value studies (Solomon *et al.* 2004; Bendle and Bell 1995; Fishkind and Associates 1993). These economic studies characterized the value placed by the public on this resource and determined that the public's willingness to pay for manatee protection is significant and that public support for manatee protection in general exists.

Bendle and Bell (1995) conducted a representative survey of Florida residents in general (through random sample) and attempted to answer the question, "How much are Florida residents willing to pay to cover the costs associated with protecting the manatee?" In 1993 dollars, efforts to protect the manatee population as a whole were valued at an estimated \$2.6 billion or \$14.78 per household (or \$4.21 billion or \$23.92 per household, when adjusted to reflect 2014 monetary values). Based on surveys of north Florida residents, Fishkind and Associates (1993) estimated that adult Florida residents would be willing to pay \$30 per year in 1992 dollars (or \$47.70 per year when adjusted to reflect 2015 monetary values) to help compensate for the adverse economic effects, if any, of protecting the manatee population (Fishkind and Associates 1993).

While neither of these studies is detailed enough to apply to this alternative specifically, they do provide an indication that the public confers substantial value on the protection of manatees.

Solomon *et al.* (2004) concluded that the benefits of manatee protection in Citrus County exceeded the development benefits forgone by approximately \$8.2 to \$9.0 million primarily because of ecotourism (or \$10.2 to \$11.2 million adjusted to 2014 monetary value).

Another potential economic benefit is continued and increased tourism that likely results from an increase in manatee protection. Citrus County and the Springs are nationally and internationally recognized as a primary destination for winter manatee viewing. Surveys of visitors to Citrus

County estimate that about half come to enjoy water based activities, including manatee viewing, snorkeling, and diving (in order of preference) (Gold 2008). Hundreds of thousands of individuals are believed to engage in this activity each winter, and the number of participants is increasing.

Most visitors and local residents view manatees in the Springs from personal or commercial watercraft. Visitors pay commercial, eco-tour operators to equip them and take them out onto Kings Bay to view manatees, which may or may not include, specifically the Springs. Vendors provide both in-water and on-water experiences. In-water rentals include wetsuits, masks, snorkels, and related gear. On-water rentals include canoe, kayak, and other boat-type rentals. Other visitors travel to the area and engage in manatee viewing activities using their own equipment, including boats and other needed gear. Many visitors to the area stay at local hotels and eat at local restaurants. Currently, manatee viewing activity costs range from \$6 for boardwalk access at the Springs to guided kayak or snorkeling tours, throughout the Bay, that average \$35 and \$50, respectively (I. Vicente 2015, pers. comm.).

Businesses that benefit both directly and indirectly from manatee viewing activities can be found in Department of Labor descriptions of Citrus County industries. While these industry descriptions provide useful information about numbers of businesses and the number of individuals employed in them, they do not describe the number of businesses and individuals engaged directly or indirectly in manatee viewing activities. These industries include: leisure and hospitality businesses; professional and business services; and trade, transportation, and utility businesses.

In 2013, statistics for employment by industry for the number of establishments engaged in ‘Leisure & Hospitality’ show 321 in Citrus County (Florida Legislature, Office of Economic and Demographic Research, January 2015). An estimate of the number of establishments across multiple categories that are potentially associated with tourism at the Springs or may promote the Springs as part of their business is 211 (I. Vicente 2015, pers. comm.; and Commercial Special Use Permit Visitors Reports 2010-2014 for Crystal River NWR). Therefore, approximately 66 percent of the leisure and hospitality economy in Citrus County may be associated with tourism at the Springs (the degree to which affected business sectors depend on manatee tourism at the Springs is not known; a few businesses may depend 100 percent on these visits while other businesses may be affected very little). However, the ‘Leisure and Hospitality’ sector comprises only 10.5 percent of the total industries in Citrus County (as compared to other sectors such as Trade, Transportation, and Utilities, 21.5 percent; and Professional and Business Services, 17.7 percent).

The economic sector associated with tourism at the Springs overlaps with that associated with the wider Kings Bay and with manatee ecotourism, in general, in that tourists likely come to see any manatees rather than specific manatees in any one given location within the Bay. As such, limiting access to the Springs for enhanced manatee and manatee habitat protection may produce a minor shift in marketing focus in terms of geographic areas within the Bay, but is unlikely to have any long-term economic impact on the ‘Leisure and Hospitality’ sector in Citrus County. Additionally, improved protection for the manatees in their winter habitat at the Springs may result in an economic benefit to these industries by ensuring the continued local presence of viewable manatees and the continued existence of the manatee viewing industry. However, the viability of the local manatee viewing industry, practiced by both commercial businesses and individuals, is challenged by reported acts of manatee disturbance and growing public perception

of unsightly and unsustainable crowding associated with unsupervised in-water activities in the Springs.

Evidence suggests that there are already operators (SUP holders) shifting their use to other areas due to crowding in and around the Springs. Additionally, there are some SUP holders who do not use the Springs but have a permit to maintain access to Kings Spring (I. Vicente. 2015, pers. comm.).

Based on previously cited studies, the Service believes that this alternative would produce some economic benefits due to improved wildlife viewing experiences. However, given the lack of detailed economic information available for estimating these benefits, the magnitude thereof is unknown.

Economic Costs

Affected Recreational Activities: For some users, the loss of winter season in-water access to these specific springs may cause them to forgo a given activity, such as snorkeling. In fact, one visitor study that relied on a variety of survey mechanisms found that the two most popular activities in Citrus County were manatee viewing and snorkeling/diving (Gold 2008). However, given the popularity of these activities, visitors are likely to seek additional areas in Kings Bay where they can recreate.

Affected Commercial Rental/Charter Boating Activities: Various types of charter boats use Citrus County waterways for nature tours and other activities. This alternative is unlikely to cause a significant adverse impact to businesses that provide charter or rental boats for manatee viewing. Enhanced manatee protection measures should improve the viewing experience and are likely to positively affect this industry. Added travel time may affect the length of a boat rental trip, which could result in fewer trips overall, creating a potential economic impact; or conversely more time on the water looking for manatees in areas other than the Springs could extend rental times and prove an economic advantage. The economic impacts of this alternative on these activities are difficult to quantify but the net impacts are expected to be minimal and temporary. This is primarily because commercial rental and charter boating activities focused on manatees are currently and may continue to expand throughout Kings Bay and at multiple springs.

This alternative would affect less than 1.5 acres of the State of Florida's 7.5 million acres of waterways and add restrictions to an already-restricted area to better protect manatees. As a result, the alternative would impact the quality of waterborne activity experiences for some recreationists and may lead some recreationists to forgo certain recreational activities, but encourage more responsible wildlife viewing. While this alternative would prohibit certain activities within the Refuge, it does not prohibit recreationists from participating in similar recreational activities elsewhere. Alternative sites are available for all recreational activities that may be affected by this alternative. While the level of economic benefits that may be attributable to this alternative is unknown (including benefits associated with manatee viewing), these benefits would more than likely offset any temporary economic costs associated with the proposed action.

Agency Administrative Costs: Agency administrative costs would include costs associated with signposting, enforcement, and some costs for education and outreach to inform the public about

new designations within the area covered by the alternative. This alternative would require nominal, additional signposting activities. Some existing signs may be removed and reused. Additional law enforcement and staff, education and outreach activities, and construction/maintenance costs are anticipated and estimated in Table 3, below:

Table 3. Estimated Agency administrative and infrastructure costs associated with Alternative B.

Anticipated Needs	Quantity	Unit Cost	Total	Justification
Staffing			Yearly	
Refuge Operations Specialist	1	\$59,848	\$59,848	supervision of additional staff
Entrance Booth Worker	6	\$27,982	\$167,892	multiple entrances/shifts
Maintenance Worker	1	\$91,478	\$91,478	increase use of infrastructure
Biological Technician	1	\$32,674	\$32,674	additional monitoring of trust species, sensitive habitats
Law Enforcement Officers	1	\$49,464	\$49,464	increased restrictions
Supervisory Visitor Services Specialist	1	\$71,736	\$71,736	supervision of additional staff and volunteers
Interpreter	6	\$27,982	\$167,892	high visitation, multiple shifts
Env. Educ. Specialist	3	\$27,982	\$83,946	high visitation, multiple shifts
Volunteer Coordinator	2	\$27,982	\$55,964	large vol. corps, multiple shifts
Construction				
Boardwalk	1	\$150,000	--	new, including engineering consult and specs
Elevated Viewing Platforms	3	\$75,000	--	new, including engineering consultation
Maintenance		\$50,000	\$50,000	weather damage, high visitation wear & tear
TOTAL		\$1,055,867	\$830,867	

Recreation and Public Access to the Springs

This alternative would modify recreational activities and current waterway access to the Springs due to seasonal closure of the spring run entrance to the Springs. These limitations would eliminate recreation in the Springs, including paddling, canoeing and snorkeling. However, this alternative would encourage wildlife viewing from land via the improved boardwalk and elevated viewing platforms. While this alternative puts the greatest limitation on seasonal access to the Springs, as in all three alternatives, it does not prohibit recreationists from snorkeling or pleasure boating via paddlecraft in public areas of Kings Bay. Alternative sites are available for all recreational activities that may be affected by this alternative.

Environmental Justice

This alternative would not have a disproportionately high adverse effect on minority or low-income populations.

2.2.2.2 Effects on Biological Environment

Under Alternative B, the Springs would be seasonally closed to all public in-water access and activities from November 15 to March 31 (with designations for closures that may be made prior to November 15 and after March 31 during cold fronts when manatees are present), to prevent potential manatee disturbance and harassment. The shorelines within the Springs would be stabilized which would benefit manatee habitat.

By seasonally closing the Springs to all in-water access, snorkelers, photographers, and paddlecraft would be absent and manatees would be able to use the Springs and the spring run without potential visitor disturbance. During cold weather, manatees would be able to rest/shelter and nurse their calves in the warm-water springs undisturbed.

Currently, the Springs is suffering severe erosion where the banks are being undercut by wintering manatees. Additionally, visitors are impacting the shoreline and vegetation. The SWFWMD's banks bioengineering project would stabilize the shorelines from current and future erosion by backfilling undercuts with soil bags and reinforcing the shoreline with limestone rocks, thereby stabilizing targeted shorelines and backfilling with material to promote root growth by existing vegetation. This would improve long-term bank stability, maintain the natural appearance of the site, and restore/improve the hydrologic function of the Springs. Preventing further erosion within the Springs would aid in protecting habitat for manatees and other aquatic animals.

Improving the boardwalk and building the elevated viewing platforms may require a limited number of trees along the boardwalk to be removed or trimmed to allow for the construction and line-of-sight for wildlife viewing.

Because this alternative would ban pets from the Springs, risk of epizootic disease outbreak may be decreased. Given the limited scientific information on movement of diseases from dogs and other pets to Florida manatees, the Service would apply the 'precautionary principle' (the precept that an action should not be taken if the consequences are uncertain and long-term impact to protected or vulnerable wildlife unpredictable). The principle would be applied with regard to this issue in order to minimize potential spread of diseases such as distemper to endangered Florida manatees where they aggregate in large numbers in this small, enclosed habitat during winter months when they may be physiologically stressed due to thermoregulation issues.

2.2.2.3 Effects on Physical Environment

Water Quality and Hydrology

Because this alternative would include supporting SWFWMD's bioengineering project to address bank erosion within the Springs, water quality and hydrology would likely improve, overall, after initial, short-term increases in turbidity during construction. Additionally, eliminating in-water visitors and crowding in the Springs, during winter months, would decrease frequency of high turbidity and low visibility over the long-term.

Noise

This alternative would address high visitor numbers and over-crowding in the Springs. Therefore, current noise levels from these activities would decrease. The bioengineering work to address bank stabilization and building of elevated viewing platforms could produce some short-term construction noise.

Aesthetics and Facilities

As this alternative would address overcrowding within the Springs themselves, perceived aesthetic impacts from these activities would likely be eliminated during manatee season.

The SWFWMD's bioengineering project to address bank erosion via stabilization would have a long-term positive effect on aesthetics. The stabilization project would decrease eroding banks and falling trees and thus the appearance of falling/dead trees. However, initially, to most visitors the installed limestone rocks would not look natural and the bank bioengineering would be evident until the vegetation grows over the new banks. This natural overgrowth is anticipated to happen rapidly given the amount of vegetation along the banks and the temperate climate of the Springs. Therefore, the Springs banks visual change would progress from a current rooted, gnarly, undercut and precipitous shoreline of crags, exposed root, and dying/leaning trees to a stable, vegetated shoreline growing on a stable base of indigenous limestone, returning the site's aesthetics to a more natural appearing and appealing condition.

Because the proposed elevated viewing platforms would be visible, they would have an impact on a portion of the Springs viewscape, since no elevated viewing platforms currently exist. However, these platforms would not rise above the treeline, and at their highest point they would remain beneath the upper tree canopy. Additionally, the platforms would be built with natural-colored construction materials to blend in with the surrounding vegetation. The platforms would materially enhance the wildlife viewing experience in new ways by diversifying view plains, creating new angles, and limiting glare. This enhanced experience would augment public experiences of the Springs' ecosystem.

Summary – Alternative B

Alternative B would meet the purpose and need of the proposed action to limit or eliminate potential disturbance of resting and nursing manatees in the Springs during the winter season and improve manatee habitat via bank stabilization. Additionally, manatee-viewing opportunities from land would be increased and improved. However, the Service recognizes that this is the most restrictive alternative regarding public in-water access, seasonally, and therefore is likely to have the most immediate but temporary economic impact on the local manatee tourism industry.

2.2.3 Alternative C - Proposed

2.2.3.1 Effects on Human Environment

Potential affects to the human environment for Alternative C include impacts to (1) human safety/recreation, (2) socioeconomic conditions, and (3) recreational and public access to the

springs. This alternative would have similar potential impacts to the human environment as that of Alternative B. However, socioeconomic and recreation/public-access impacts are likely to be less given the controlled, limited in-water access to the Springs provided for in this proposed alternative versus the complete elimination of in-water access during manatee season, as proposed in Alternative B.

Human Safety/Recreation

This alternative has the same human safety benefits of Alternative B – eliminating the potential hazard of crowding of swimmers/snorkelers with paddlers – but with an increased combination of safety via guided in-water tours in the springs. Trained and insured guides would not only provide for increased in-water safety, but would also enhance the wildlife-viewing experience beyond basic recreation by interpreting the manatees' natural behavior in the Springs habitat.

Socioeconomic Conditions

Economic Benefits

The Service believes this alternative, as in Alternative B, would increase the level of manatee protection in this area. Improved protection for the manatee may result in direct economic benefits by ensuring the continued, local presence of viewable manatees and the continued existence of the manatee viewing industry. Indirect benefits include the protection of aquatic vegetation from losses due to excessive turbidity, and noise reduction from decreased crowding in the Springs, which may increase property values.

As detailed in Alternative B, the public's support for manatees and their protection has been examined through several studies finding that the public's willingness to pay for manatee protection is significant and that public support for manatee protection in general exists. Based on previous studies, the Service believes that this alternative would produce more economic benefit than Alternative B, given the opportunity to develop limited, guided in-water manatee viewing experiences in the Springs. However, given the lack of information available for estimating these benefits, their magnitude is unknown.

Economic Costs

Affected Recreational Activities: For some users, the loss of winter season in-water access to the Springs via the spring run may cause them to forgo a given activity, such as snorkeling or paddling. However, based on one visitor study that relied on a variety of survey mechanisms, the two most popular activities in Citrus County were manatee viewing and snorkeling/diving (Gold 2008). Such paying visitors are likely to seek opportunities to view manatees in alternate areas of the Kings Bay or from land.

Affected Commercial Rental/Charter Boating Activities: Various types of charter boats use Citrus County waterways for nature tours and other activities. This alternative is unlikely to cause a significant adverse impact to businesses that provide charter or rental boats for manatee viewing and may even benefit them. Added travel time looking for manatee viewing opportunities may affect the length of a trip/rental, which could result in fewer trips overall, creating a potential economic impact; or conversely, more time on the water looking for manatees in areas other than outside the Springs, which could extend rental times and prove an

economic advantage. The economic cost of this alternative on these activities cannot be quantified, but are likely to be minimal.

Agency Administrative Costs: Agency administrative costs would include costs associated with developing infrastructure needs to support land-based water access for guides and visitors. This alternative would require some additional staff and some construction/maintenance costs which are estimated in Table 4, below:

Table 4. Estimated Agency administrative and infrastructure costs associated with Alternative C.

Anticipated Needs	Quantity	Unit Cost	Total	Justification
Staffing			Yearly	
Refuge Operations Specialist	0	\$0	\$0	
Entrance Booth Worker	3	\$27,982	\$83,946	multiple entrances/shifts
Maintenance Worker	1	\$91,478	\$91,478	increase use of infrastructure
Biological Technician	1	\$32,674	\$32,674	additional monitoring of trust species, sensitive habitats
Law Enforcement Officers	0	\$0	\$0	
Supervisory Visitor Services Specialist	1	\$71,736	\$71,736	supervision of additional staff and volunteers
Interpreter	1	\$27,982	\$27,982	high visitation, multiple shifts
Env. Educ. Specialist	0	\$0	\$0	
Volunteer Coordinator	1	\$27,982	\$27,982	large vol. corps
Construction				
Boardwalk	1	\$150,000	--	new, including engineering consult and specs
Elevated Viewing Platforms	3	\$75,000	--	new, including engineering consultation
Floating Dock	1	\$50,000	--	Shore-based water access
Maintenance		\$50,000	\$50,000	weather damage, high visitation wear & tear
TOTAL		\$660,771	\$385,771	

As in Alternative B, this alternative would affect less than 1.5 acres of the State of Florida's 7.5 million acres of waterways and would add restrictions to an already restricted area to better protect manatees. As a result, Alternative C would impact the variety of in-water activities for some visitors and may lead some to forgo certain activities, but at the same time may encourage more rewarding and responsible wildlife viewing. While this alternative would prohibit certain activities within the Springs, it does not prohibit recreationists from participating in similar recreational activities elsewhere. Alternative sites are available for all recreational activities that may be affected by this alternative. While the level of economic benefits that may be attributable to this alternative is unknown (including benefits associated with manatee viewing), these benefits would likely minimize any economic impacts that may be associated with the proposed action.

Recreation and Public Access to the Springs

This alternative would modify in-water activities in the Springs and current waterway access to the Springs due to access limitations via the spring run during manatee season. These limitations would impact the amount of in-water activity experiences for some recreationists and may lead some recreationists to forgo certain in-water activities. However, in-water manatee viewing would be available from an ADA-compliant floating dock within the Springs with an FWC-certified guide. Alternative sites are available for all legal, in-water activities that may be affected by this rule.

Environmental Justice

This alternative would not have a disproportionately high adverse effect on minority or low-income populations.

2.2.3.2 Effects on Biological Environment

The current condition of the Springs biological environment attributes, including water quality, vegetative communities, and wildlife habitat, would not experience any negative impacts under this alternative.

Under Alternative C, the Springs would be seasonally closed to all in-water access via the narrow spring run from November 15 to March 31 (with designations for closures that may be made prior to November 15 and after March 31 during cold fronts when manatees are present), to prevent potential manatee disturbance. The shorelines within the Springs would be stabilized which would benefit manatee habitat.

By seasonally closing the Springs to all in-water access via the spring run, paddlecraft would be absent and manatees would be able to enter and exit the Springs with less potential disturbance. Additionally, given the two closed lobes, manatees would be able to rest and nurse their calves undisturbed in these no-entry areas even while guided snorkel tours are being conducted.

Currently, the Springs is suffering severe erosion where both human visitors and manatees are suspect in contributing to undercutting of the spring banks. SWFWMD's bank stabilization project would stabilize the shorelines from current and future erosion by backfilling undercuts with soil bags and reinforcing the shoreline with limestone rocks, thereby stabilizing targeted shorelines and backfilling with material to promote root growth by existing vegetation. This would improve long-term bank stability, maintain the natural appearance of the site, and restore/improve the hydrologic function of the Springs.

Improving the boardwalk and building the elevated viewing platforms may require a limited number of trees along the boardwalk to be removed or trimmed to allow for the construction and line-of-sight for wildlife viewing.

Because this alternative would ban pets from the Springs, risk of epizootic disease outbreak may be decreased. Given the limited scientific information on movement of diseases from dogs and other pets to Florida manatees, the Service would apply the 'precautionary principle' (the precept that an action should not be taken if the consequences are uncertain and long-term impact to

protected or vulnerable wildlife unpredictable). The principle would be applied with regard to this issue in order to minimize potential spread of diseases such as distemper to endangered Florida manatees where they aggregate in large numbers in this small, enclosed habitat during winter months when they may be physiologically stressed due to thermoregulation issues.

2.2.3.3 Effects on Physical Environment

Water Quality and Hydrology

Because this alternative would include supporting SWFWMD's bioengineering project to address bank erosion within the Springs, water quality and hydrology would likely improve, overall, after initial, short-term increases in turbidity during construction. Additionally, limiting and guiding all in-water visitors in the Springs, during winter months, would substantially decrease frequency of overcrowding and thus of high turbidity and low visibility over the long-term.

Noise

This alternative would address high visitor numbers and over-crowding in the Springs. Therefore, current noise levels from these activities would decrease. The bioengineering work to address bank stabilization, building of elevated viewing platforms, and construction of the floating dock could produce some short-term construction noise.

Aesthetics and Facilities

As this alternative would address overcrowding within the Springs, perceived aesthetic impacts from these activities would likely diminish during manatee season.

The SWFWMD's bioengineering project to address bank erosion via stabilization would have a long-term positive effect on aesthetics. The stabilization project would decrease eroding banks and falling trees and thus the appearance of falling/dead trees. However, initially, to most visitors the installed limestone rocks would not look natural and the bank bioengineering would be evident until the vegetation grows over the new banks. This natural overgrowth is anticipated to happen rapidly given the amount of vegetation along the banks and the temperate climate of the Springs. Therefore, the Springs banks visual change would progress from a current rooted, gnarly, undercut and precipitous shoreline of crags, exposed root, and dying/leaning trees to a stable, vegetated shoreline growing on a stable base of indigenous limestone, returning the site's aesthetics to a more natural appearing and appealing condition.

Because the proposed elevated viewing platforms would be visible, they would have an impact on a portion of the Springs viewscape, since no elevated viewing platforms currently exist. However, these platforms would not rise above the treeline, and at their highest point they would remain beneath the upper tree canopy. Additionally, the platforms would be built with natural-colored construction materials to blend in with the surrounding vegetation. The platforms would materially enhance the wildlife viewing experience in new ways by diversifying view plains, creating new angles, and limiting glare. This enhanced experience would augment public experiences of the Springs' ecosystem.

An ADA-accessible floating dock would add a boardwalk-adjacent walkway and would introduce a new in-water structure. The access ramp to the dock and the floating dock would be constructed using natural-looking construction materials to best blend in with the surrounding vegetation and landscape. Additionally, the dock would be tucked into a natural cove in the Springs and would not be visible from the most scenic spring vista so as not to compromise this view shed. It would be a low profile, floating structure, rather than a fixed in-water structure, with only the minimum surface area required by ADA engineering standards. The structure would be placed under existing overhanging trees as closely configured to the Springs bank as possible and would be removable in the off-season.

Summary – Alternative C

Alternative C would meet the purpose and need of the proposed action in its entirety. While the alternative would limit recreational access to the springs, it would enhance and improve the public's wildlife viewing experience in the Springs. As with Alternative B, the Service recognizes that this alternative would have some immediate but temporary economic impact. This alternative would increase the level of manatee protection in the area overall while continuing to provide for sustainable ecotourism. Improved protection for the manatee may result in direct economic benefits by ensuring the continued, local presence of undisturbed and thus viewable manatees, thereby ensuring the continued existence of the manatee viewing industry.

2.3 Summary of Environmental Consequences by Alternative

Table 4, below, provides a summary of the environmental consequences for each of the alternatives proposed in this EA.

Table 4.

<i>IMPACT</i>	<i>RESOURCE CATEGORY</i>	<i>Alternative A</i>	<i>Alternative B</i>	<i>Alternative C</i>
<i>Human Environment</i>	<i>Human Safety</i>	Would not change existing human safety conditions.	Would improve human safety in Three Sisters Springs.	Would improve human safety in Three Sisters Springs.
	<i>Socioeconomic conditions</i>	Would not, directly, change existing socioeconomic conditions.	Would affect community services or community cohesion. Some measurable effects are anticipated in regards to communities or individuals.	Would affect community services or community cohesion. Some effects are anticipated in regards to communities or individuals.
	<i>Recreation and public access</i>	Would not, directly, change existing recreation and public access conditions.	Would eliminate recreational activities occurring in Three Sisters Springs, in water, during manatee season. Would affect current waterway access practices.	Would modify kinds of recreational activities occurring in Three Sisters Springs, in water, during manatee season. Would affect current waterway access practices.
	<i>Environmental Justice</i>	Would have no disproportionate adverse effects on low-income or minority populations.	Would have no disproportionate adverse effects on low-income or minority populations.	Would have no disproportionate adverse effects on low-income or minority populations.
<i>Biological Environment</i>	<i>Wildlife (not including listed species)</i>	Would not, directly, change existing wildlife and would improve habitat beyond existing conditions.	Would not change existing wildlife and would improve habitat beyond existing conditions.	Would not change existing wildlife and would improve habitat beyond existing conditions.
	<i>Vegetation</i>	Would temporarily change existing vegetation and improve habitat beyond existing conditions. This alternative would not affect distribution, abundance, or trends in populations of exotic plant species.	Would temporarily change existing vegetation and improve habitat beyond existing conditions. This alternative would not affect distribution, abundance, or trends in populations of exotic plant species.	Would temporarily change existing vegetation and improve habitat beyond existing conditions. This alternative would not affect distribution, abundance, or trends in populations of exotic plant species.
	<i>Endangered and Threatened Species</i>	Would perpetuate increasing number of manatees potentially disturbed in Three Sisters Springs. This alternative would not affect other Federal candidate, proposed, or listed animal species or critical habitat beyond existing conditions.	Would eliminate potential disturbance of manatees in Three Sisters Springs. This alternative would not affect other Federal candidate, proposed, or listed animal species or critical habitat beyond existing conditions.	Would minimize potential disturbance of manatees in Three Sisters Springs. This alternative would not affect other Federal candidate, proposed, or listed animal species or critical habitat beyond existing conditions.
<i>Physical Environment</i>	<i>Water Quality & Hydrology</i>	This alternative would not change current water quality and would improve hydrology.	This alternative may improve current water quality and would improve hydrology.	This alternative may improve current water quality and would improve hydrology.
	<i>Noise</i>	This alternative would not change existing noise levels associated with Three Sisters Springs.	This alternative would potentially lower noise levels associated with Three Sisters Springs.	This alternative would potentially lower noise levels associated with Three Sisters Springs.
	<i>Aesthetics & Facilities</i>	This alternative would not change existing facilities and would temporarily affect aesthetics.	This alternative would improve existing facilities and would temporarily affect aesthetics.	This alternative would improve existing facilities and would temporarily affect aesthetics.

Alternative A: No action; maintain existing management measures.

Alternative B: No in-water access or activity during manatee season, improved land-based manatee viewing, and habitat improvements via bank stabilization.

Alternative C: Proposed; limited, guided in-water manatee viewing, improved land-based manatee viewing and habitat improvements via bank stabilization.

2.4 Cumulative Effects

NEPA defines “cumulative impacts” as the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Some manatee populations may be increasing and/or stabilizing in the face of past actions by federal, state, and local governments. Based on the 5-year review conducted by the Service in 2007 (USFWS 2007), the best available science shows the overall population of the Florida manatee has increased while the Antillean manatee population in Puerto Rico is stable. Status review to reclassify the manatee from endangered to threatened has begun. However, human-induced threats to the species, including fatal boat strikes, injury, disease, and harassment, and habitat alteration continue requiring on-going and additional actions (such as the proposed alternative) to support manatee conservation to the point at which the species no longer requires protection under the ESA. Pursuant to the Service’s and the Refuge’s mission, we continue assessing this information with the goal of meeting our manatee recovery objectives.

Observations by law enforcement officers and manatee researchers imply that disturbance of manatees is reduced in areas designated as refuges, or sanctuaries or where swimmer and boaters are excluded (C. Cavanna 2014, pers. comm.; Wolfe & Syverson 2015). This indicates that, on a site-specific basis, previous actions to protect the manatee have been successful. However, public swim-with areas can experience potential human-related manatee disturbance. The designation of manatee resting areas within the Springs is expected to prevent disturbance of manatees in these areas and would enhance public experience and awareness of the measures necessary to protect the manatee. The cumulative impacts such as loss of recreational areas, and any inconvenience that visitors may experience due to these manatee-resting areas being closed, would generally be mitigated by improved visitor experience, overall.

Cumulatively and initially, socioeconomic impacts may occur as ecotourism practices refocus on manatee viewing that is more sustainable, such as observational experiences from land, or, in refuge managed waters, in-water tours that are guided by FWS-certified guides as detailed in Sections 2.2.2.1 and 2.2.3.1. Eventually, this cumulative impact may provide an economic gain by not only safeguarding manatee habitat and manatees, the focus of ecotourism profits, but also by continuing to create a world-class destination that promotes sustainable, educational wildlife viewing experiences.

2.5 Unavoidable Impacts and Minimization Measures

If the proposed action is selected, the Service believes that there would be negligible effects to natural, cultural, aesthetic, and socioeconomic resources and that the proposed management actions would also ensure that possible impacts to manatees are avoided. However, Crystal River NWR understands that some individuals may be temporarily impacted due to implementation of the proposed action. Therefore, to help expand nature-based tourism opportunities, the refuge would work with our partners including the community, The Tourism Development Council, the City of Crystal River, and the chambers of commerce to promote alternative and/or additional, sustainable wildlife viewing opportunities throughout Kings Bay. Within the broader context, the Refuge proposes to work with Citrus County, the City of Crystal River, the community, and

neighboring cities/counties to help develop a more comprehensive, nature-based tourism culture/identity across the Nature Coast landscape, including federal and state lands and waters at Chassahowitzka NWR's Salt Marsh Trail, Ozello, Cedar Key and Lower Suwannee NWRs, Rainbow Springs State Park, Chassahowitzka State Park, Crystal River Archaeological State Park, Crystal River Preserve State Park, Fort Cooper State Park, Potts Preserve, St. Martins Marsh Aquatic Preserve, Withlacoochee State Forest, Yulee Sugar Mill Ruins Historic State Park, Two Mile Prairie, Homosassa Wildlife Park, and other protected natural areas throughout the county and surrounding areas. In order to offset some of the potential impacts associated with the proposed alternative, several options are being explored within Kings Bay. These options include:

- In partnership with the community, install a small floating dock on the canal adjunct to the Springs to allow water-to-land access to the boardwalk for paddlers and snorkelers. This would offer recreational paddlers and snorkelers the opportunity to view manatees within the Springs from the boardwalk.
- Review data collected on manatee distribution within the Springs to determine if inserts (small key holes) into the center of lobe closures may facilitate additional in-water wildlife viewing. Depending on manatee distribution, "key holes" could provide extra areas for sustainable in-water viewing of manatees in their natural habitat, while minimizing the potential for disturbance by guided snorkelers (Figure 12).
- The refuge would consider adding an additional "keyhole" in refuge waters at the Mullet Hole near Kings Spring. The Mullet Hole "keyhole" would potentially create additional sustainable wildlife-dependent in-water viewing for visitors. This design would allow wildlife-viewing visitors the ability to observe manatees in-water while lessening the potential for disturbance (Figure 13).
- In order to achieve the future plans of allowing sustainable wildlife viewing of manatees, an ADA-compliant floating dock, ramp, and observation tower(s) would be considered for construction to allow visitor access to viewing manatees from refuge lands on Banana Island. The floating dock would be located on the northeast side of the island with a ramp running across the island to an elevated observation platform overlooking Mullet Hole and/or the Kings Spring. This additional wildlife viewing opportunity would allow visitors to observe manatees within seasonally closed refuge waters, from an elevated site on land.

The Refuge would continue to look for opportunities to develop a comprehensive, sustainable wildlife viewing culture/experience in accordance with the Improvement Act across the Crystal River NWR Complex, including Crystal River, Chassahowitzka, and Tampa Bay NWRs. We would also partner with the City of Crystal River and local tour operators to diversify sustainable manatee viewing experiences throughout Kings Bay. Potential mitigation measures proposed outside of the Springs would be considered in the pending Comprehensive Conservation Plan and associated EA for Crystal River NWR, which are in development.



Figure 12. Potential mitigation measure at the Springs; small “keyholes” for guided, in-water manatee viewing (above)

Figure 13. Potential mitigation measures at Banana Island; a manatee-viewing ‘key hole’ at Kings Spring; ADA-compliant floating dock, ramp, and elevated viewing platform (below)



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Acronyms:

ADA – Americans with Disabilities Act

CFR – Code of Federal Regulations

CRNWR – Crystal River National Wildlife Refuge

EA – Environmental Assessment

ESA – Endangered Species Act

FWC or FFWCC– Florida Fish and Wildlife Conservation Commission

FWRI – Florida Fisheries and Wildlife Research Institute

FWS – Fish and Wildlife Service

MMC – Marine Mammal Commission

MMPA – Marine Mammal Protection Act

NEPA – National Environmental Protection Act

NMFS – National Marine Fisheries Service

NWR – National Wildlife Refuge

SUP – Special Use Permit

SWFWMD – Southwest Florida Water Management District

USFWS – United States Fish and Wildlife Service

USGS – United States Geological Service

Appendices I-VII

I. Section-7 Consultation

II. Proposed Application Process for Commercial In-water Guiding Services

III. Draft Inventory Protocol

IV. In-Water Guide Selection and Certification Process

V. Proposed Lottery System for Commercial Photographers and Filmers

VI. Proposed Standards of Conduct

VII. Species List

Three Sisters Springs Unit of Crystal River National Wildlife Refuge:
Aquatic Habitat and Wildlife-Viewing Improvements
Citrus County, Florida

Environmental Assessment

APPENDICES

Appendix I

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION

DRAFT

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Andrew Gude

Telephone Number: 352 563-2088 ext 202; CELL 703 622-3896

E-mail Address: Andrew_Gude@fws.gov

Date: July XX, 2015

I. Region: Fish and Wildlife Service (FWS or Service), Region 4 (Southeast)

II. Service Activity (Program): National Wildlife Refuge (NWR) System

III. Geographic area or station name: Crystal River National Wildlife Refuge (CRNWR or Refuge).

IV. Location:

A. Ecoregion Number and Name: 32-North Florida Ecosystem

B. County and State: Citrus County, Florida

C. Section, township, and range (or latitude and longitude): Section 28, Township 18S, Range 17E; Latitude: 28.88872533, Longitude: -82.58919102

D. Distance (miles) and direction to nearest town:

Within the City of Crystal River's city limits. See Map 1

V. Action Area: Three Sisters Springs (the Springs)

VI. Pertinent Species and Habitat:

A. Listed species potentially present within the action area:

1) West Indian manatee (*Trichechus manatus*)

2) Wood stork (*Mycteria americana*)

B. Proposed species and/or proposed critical habitat within the action area:

The action area is located in designated critical habitat for the West Indian manatee.

C. Candidate species within the action area:

None.

D. Include species/habitat occurrence on a map.

Local species/habitat occurrence maps are not available for these species.

VII. Species/habitat occurrence:

A. West Indian manatees are associated with the warm water springs and the spring run/access corridor located within the action area (Three Sisters Springs), primarily during the winter months.

B. Wood storks are associated with roosting trees located within the action area.

VIII. Need for the Proposed Action

The Florida manatee (*Trichechus manatus latirostris*) (a subspecies of the listed entity, the West Indian manatee, *Trichechus manatus*) is an Endangered Species Act (ESA), and Marine Mammal Protection Act (MMPA) protected trust species.

Florida manatees travel and congregate in the warm water springs found in Three Sisters Springs, Kings Bay. Hundreds of manatees are known to seek refuge in the Springs to shelter from the cold. This aggregation of manatees attracts tens of thousands of people who come to view them from non-motorized vessels, while swimming in the water, and from an adjoining boardwalk. The number of manatees using the area and number of visitors to the site are increasing each year. In February 2015, a record 706 manatees were counted in Kings Bay, including over 450 manatees in the Springs.

Manatees have been impeded by swimmers and paddlecraft in the spring run while traveling to and from the Springs. They have also been disturbed in the Springs while resting, nursing, and engaging in other natural behaviors. When disturbed, manatees may leave the area and/or alter their normal behavior patterns. Crowding by visitors may also cause manatees to leave the action area. The proposed action is needed to minimize the potential for viewing-related manatee disturbance and to allow manatees unimpeded access to the Springs.

IX. Description of the Proposed Action

The CRNWR seeks to implement the following management measures (or actions) during the manatee season: November 1 – April 15 at Three Sisters Springs in order to address potential manatee viewing-related disturbance. The proposed actions are for the Three Sisters Springs Unit of the CRNWR, managed under the authority of the National Wildlife Refuge Administration

Act (NWRAA), the ESA, and the MMPA. These actions are intended to manage visitor activities and numbers within the Springs in order to protect manatees from potential viewing-related manatee disturbance and conserve the natural environment of the Springs as a National Wildlife Refuge. The proposed actions include:

1) Close all in-water access to the Springs via the narrow spring run during manatee season, November 15 through March 31 (CRNWR can extend the season in the event of cold weather and enact protective measures from November 1 and until April 15, as necessary) and provide limited in-water access from the boardwalk;

Purpose: Manatee ingress and egress to Three Sisters Springs is blocked on many occasions by visitors in the spring run. At the narrowest point during mid-tide, the spring run is approximately five feet wide, and creates a bottleneck for swimmers, paddle-craft, and manatees. On one of the busiest days recorded, December 27, 2015, total passages by manatees, snorkelers, and paddlers (including kayaks, canoes, and paddle boards) through the spring run was 2,325 or one every 15.4 seconds. This volume of visitation and the mere presence of visitors in the spring run may compromise manatee movement patterns and behavior. By keeping in-water recreationalists out of the spring run, the Refuge is eliminating this risk. The refuge will also minimize the potential for viewing-related manatee disturbance caused by large numbers of visitors in the Springs by providing small numbers of guided visitors with in-water access from the boardwalk. Extending the season will allow CRNWR to prevent congestion and blockages in the spring run and large numbers of visitors to the Springs during early and late winter cold fronts, as needed.

Justifications:

- Allows manatees to enter/exit spring run undisturbed during manatee season.
- Closing the spring run and allowing limited in-water access from the boardwalk reduces the potential for manatee disturbance.

Data: Observations by Refuge staff, seasonal manatee inventory data, Tour Operator Visitor Reports (2014-15 visitor numbers), boardwalk visitors' survey including visitor numbers, crowding assessments, visitor feedback; additionally, numbers of documented violations increased over time correlated with increased visitor numbers.

2) Provide daily in-water access to limited numbers of visitors guided by Commercial Special-Use Permit (SUP) holders (guides) from an American with Disabilities Act (ADA) compliant floating dock attached to the boardwalk by a ramp. Access will be conditioned by numbers of manatees present, temperatures, and tides.

Purpose: Service policies, strategies, and requirements concerning the management of wildlife-dependent recreation programs within the NWR System focus on providing opportunities for quality recreational and educational experiences that do not compromise ecological integrity. As described in Number 1 above, the Service proposes to close the spring run and provide limited in water access to visitors via the boardwalk. Visitors will be escorted to Three Sisters Springs by guides on a limited and controlled basis. Controlling the number of visitors to the spring and

limiting in-water viewing reduces the potential for viewing-related manatee disturbance. By conditioning access based on numbers of manatees present, temperatures, and tides, potential visitor disturbance of resting manatees will be further reduced.

Justifications:

- Guides will provide a quality recreational and educational experience and will ensure that visitor actions do not disturb manatees.
- Controlling in-water visitor crowding reduces the potential for viewing-related manatee disturbance.
- Limiting visitor access to those times when conditions are appropriate will further minimize viewing-related manatee disturbance.

Data: Observations by Refuge staff, seasonal manatee inventory data, Tour Operator Visitor Reports (2014-15 visitor numbers), boardwalk visitors' survey including visitor numbers, crowding assessments, and visitor feedback.

3) Require SUP holding, FWS-certified guides to accompany and supervise visitors during in-water tours inside Three Sisters Springs; standardize Springs-specific guide certification for guides; and institute Standards of Conduct for guides, and their clients that supports and promotes responsible, sustainable wildlife-viewing and the ecotourism industry;

Purpose: Each wildlife-dependent recreational activity must be determined to be appropriate and compatible on a NWR (i.e. activities cannot materially interfere with or detract from the fulfillment of the NWR System mission or the Refuge's specific purposes). By requiring certified guides and by providing certification training to guides and their clients, visitors will be provided with a wildlife viewing experience that reduces the potential for adverse effects on wintering manatees. Education provided to the guides also decreases the possibility of that visitors will violate the 12 Prohibitions. The Standards of Conduct that guides and their clients abide by includes measures that minimize manatee viewing-related disturbance and supports and promotes responsible and sustainable wildlife-viewing and the ecotourism industry.

Justifications:

- Providing Service-trained guides ensures that clients and visitors are knowledgeable of rules and guidelines for manatee viewing and minimizes viewing-related manatee disturbance.
- Providing standardized, Springs-specific training provides consistent, quality information to visitors and improves the wildlife viewing experience.
- Standards of Conduct, including the 12 Prohibitions, increases in-water visitor compliance with rules and guidelines that minimize manatee viewing-related disturbance when supervised by certified guides.

Data: Observations by Refuge staff, seasonal manatee inventory data, Tour Operator Visitor Reports (2014-15 visitor numbers), boardwalk visitors' survey including visitor numbers, crowding assessments, and visitor feedback

4) Require and limit the number of Special Use Permits (SUPs) for commercial photographers and videographers and prohibit the use of flash photography at Three Sisters Springs; SUPs for diffused flash photography would be issued for educational or research purposes only;

Purpose: The purpose of this action is to minimize the effects of commercial photographers, videographers, and flash photography on manatees. Photographers may approach and engage in activities that can disturb manatees while photographing them. Camera flashes may startle manatees and disturb normal behaviors. Requiring and limiting the number of SUPs issued to photographers will reduce the potential for photography-related manatee disturbance. A prohibition on flash photography and only allowing limited diffused flash photography will minimize flash-related manatee disturbance. Currently, the Service's Division of Management Authority's permitting requires a 20-foot minimum approach distance from any manatee when using any artificial photographic lighting. This, combined with a robust SUP training program, limits on the number of SUPs for photographers, and limits on diffused flash photography should reduce the potential for adverse effects of photographic activities.

Justifications:

- Reduces the potential for compromising manatee behavior due to photographers and flash photography.
- Complies with existing Service policies and guidelines.

Data: Scientific literature review. Observations by Refuge staff,

5) Amend SUP conditions for guides to require them to have a City of Crystal River business license or exemption letter and in-water insurance.

Purpose: Requiring a City of Crystal River business license or exemption letter that requires licensees to be knowledgeable of the 12 Prohibitions and Standards of Conduct insures that all guides providing manatee viewing opportunities are aware of these protocols and has some potential to reduce the risk of manatee viewing-related disturbance. However, the requirement for insurance has no direct or indirect effect on manatees.

Justifications:

- Reduces the potential to alter manatee behavior.
- Increases in-water visitor safety

6) Close two lobes (Pretty Sister and Little Sister) to in-water access during manatee season, as needed, in response to key environmental factors, i.e. numbers of manatees present, temperatures, and tides.

Purpose: The physiology of manatees requires that they thermoregulate in the warmer waters of the Springs during the colder winter months, beginning when Gulf water temperatures start to drop. Manatees prefer shallow areas in order to conserve energy when surfacing to breathe while resting on the bottom. This is especially true of mother/calf pairs. Closing the shallow eastern and western lobes of the springs during these times allows manatees to seek refuge in undisturbed ‘sanctuaries’ within the Springs themselves. As temperatures drop and manatee numbers increase, this measure allows for additional adaptive measures.

Justifications:

- Creates protected areas for resting manatees, including cow/calf pairs, as needed. (Staff has documented that these two shallow lobes are where the majority of manatees rest, sleep, and nurse their calves.)
- Reduces the potential to alter manatee behavior by in-water viewing activities.
- Monitoring manatee usage allows management measures to be adaptive based on observations.

Data: Staff observations, and manatee usage pre/post closures of lobes.

7) Institute Standards of Conduct for SUP holders, guides, clients, and in-water visitors that support and promote responsible, sustainable wildlife viewing.

Purpose: Each wildlife-dependent recreational activity must be determined to be appropriate and compatible on a NWR (i.e. an activity cannot materially interfere with or detract from the fulfillment of the NWR System mission or the Refuge’s specific purposes. Wildlife disturbance that is limited in scope or duration may not interfere with fulfilling the System’s mission or refuge purposes. By instituting Standards of Conduct and training program, refuge managers can ensure fulfillment of the Refuge mission while providing oversight for SUP holders and vendors operating on refuge managed lands.

Justifications:

- Improves the quality of wildlife viewing experiences while reducing the potential for manatee viewing-related disturbance.
- Increases SUP holder knowledge of their responsibilities while operating on NWR property.

8) Prohibit pets on the boardwalk, shoreline, or in the water at Three Sisters Springs, including the spring run.

Purpose: Animal waste washed into waterways during storm events can expose manatees to harmful pathogens. Researchers recently documented toxoplasmosis in manatees in Puerto Rico, a disease likely introduced by the surface runoff of cat feces into waterways inhabited by manatees (Bossart 2014). To reduce the likelihood of disease exposure to manatees at Three

Sisters Springs, CRNWR will prohibit pets on the boardwalk, shoreline, and in the water. Exceptions will be made for service animals.

Justifications:

- Reduces risk of potential epizootic disease transmission from domestic pets to manatees.

Data: Scientific literature review.

9) Build an elevated viewing platform(s) to enhance wildlife-viewing and manatee photography opportunities and improve the existing boardwalk for safety reasons and to comply with the Americans with Disability Act (ADA).

Purpose: To enhance manatee viewing and photography opportunities, CRNWR will build an elevated viewing platform along the southwestern shore of the Springs. The elevated platform will allow visitors to view and photograph manatees from a vantage point above the shorelines' fringing vegetation, which obscures views. The existing boardwalk will be re-engineered to provide non-slip surfaces to improve safety and railings will be constructed to provide mobility-impaired visitors with views of the Springs. .

Justifications:

- Improve and diversify wildlife viewing and photography opportunities.
Safer construction eliminates safety risks.

Data: Engineering review.

X. Explanation of Effects of the Action on Species in Section VI

The proposed measures will minimize the effect that visitor activities and increasing numbers of visitors may have on manatees by reducing the potential for direct interactions. These will supplement existing management measures and provide better control of human activities when manatees are present in Three Sisters Springs. Specifically:

- **Measure 1** restricts in-water access through a floating dock only accessible from shore. This will keep in- and on-water recreationists from blocking manatees entering and leaving the Springs in the spring run.
- **Measure 2** will limit the number of in-water visitors viewing manatees within the Springs. Limiting the number of visitors will reduce the number of visitor interactions with manatees. Limited numbers of visitors accessing the Springs will be accompanied by a Refuge-certified SUP holder (guide) who will ensure that manatee viewing activities do not disturb manatees. Restricting access from the shore only, reducing visitor numbers, and ensuring that guided visitors do not disturb manatees will minimize potential manatee viewing-related harassment.

- **Measure 3** will require Refuge-certified guides to accompany and supervise in-water visitors while in the Springs. Certified guides will be knowledgeable about responsible manatee viewing, including regulations. They will ensure that the actions of their clients do not have the potential to disturb manatees.
- **Measure 4** minimizes the potential for in-water photographers/videographers and flash photography to disturb manatees. By requiring photographers to have SUPs, by conditioning the SUPs to minimize manatee disturbance, by limiting the number of SUPs issued to photographers, and by prohibiting flash photography, manatee disturbance will be minimized.
- **Measure 5** amends SUPs to include a condition requiring permit holders to obtain a business license from the City of Crystal River and to carry insurance that protects their clients. By restricting manatee viewing guides to those licensed by the City and insured, there should be fewer guides unfamiliar with local rules and regulations operating in Kings Bay. This will improve compliance with manatee viewing measures and visitor safety.
- **Measure 6** adopts lobe closures within the Springs. These closures will keep visitors out of these areas and will allow manatees to remain here undisturbed by human activities.
- **Measure 7** adopts Standards of Conduct for SUP holders, guides, and visitors that promote responsible manatee viewing. The Standards will ensure that manatee-viewing activities are appropriate and compatible with the Refuge mission and purposes and will provide additional oversight over SUP holders and vendors operating on refuge managed lands.
- **Measure 8** prohibits pets from the boardwalk, shoreline, and in the water at Three Sisters Springs (except for service animals). By prohibiting pets from these locations, animal waste will be prevented from running off into the Springs where it can expose manatees to diseases.
- **Measure 9** constructs elevated viewing platform(s), improves boardwalk safety, and ensures that the structures are ADA compliant. These actions improve viewing opportunities and safety.

Because the confined springs at Three Sisters Springs are one of the few wintering manatee aggregation areas where in-water human access is not controlled, inappropriate interactions between humans and manatees can occur. Based on the Service's Biological Evaluation, we conclude that implementation of the measures proposed in Alternative C of the EA, along with continued efforts by Refuge Law Enforcement, will reduce the likelihood of visitor harassment at this site to insignificant or discountable levels by reducing the potential for close interactions between humans and manatees. The way in which these measures will reduce the likelihood of visitor harassment is explained in the latter part of Section 2.2.3.2 of the EA (section title: *Effects to Biological Environment*).

Florida manatees

Implementation of these measures will not directly or indirectly affect on-site critical habitat elements such as drinking water and warm water.

Wood storks

Wood storks are rarely on-site and when present may roost in fringing trees. There are little to no shallow foraging areas along the shoreline. Given that these measures address in-water activities where wood storks are not found, implementation of these measures should have no measurable effects on wood storks that may be in the area.

A. Explanation of actions to be implemented to reduce adverse effects:

West Indian manatee

Implementation of these measures should benefit manatees that use the area. As a result, these actions are not expected to adversely affect manatees using the action area or to designated critical habitat.

Wood storks

Given that use of the action area by wood storks is limited to a few roost trees, and the proposed actions are in-water related, the actions are not expected to adversely affect wood storks.

XI. Effect determination and response requested:

A. Species

Species	Determination			Response Requested
	No Effect	Not Likely to Adversely Affect	May Affect	Concur
West Indian manatee		X		
Wood stork		X		

B. Designated critical habitat

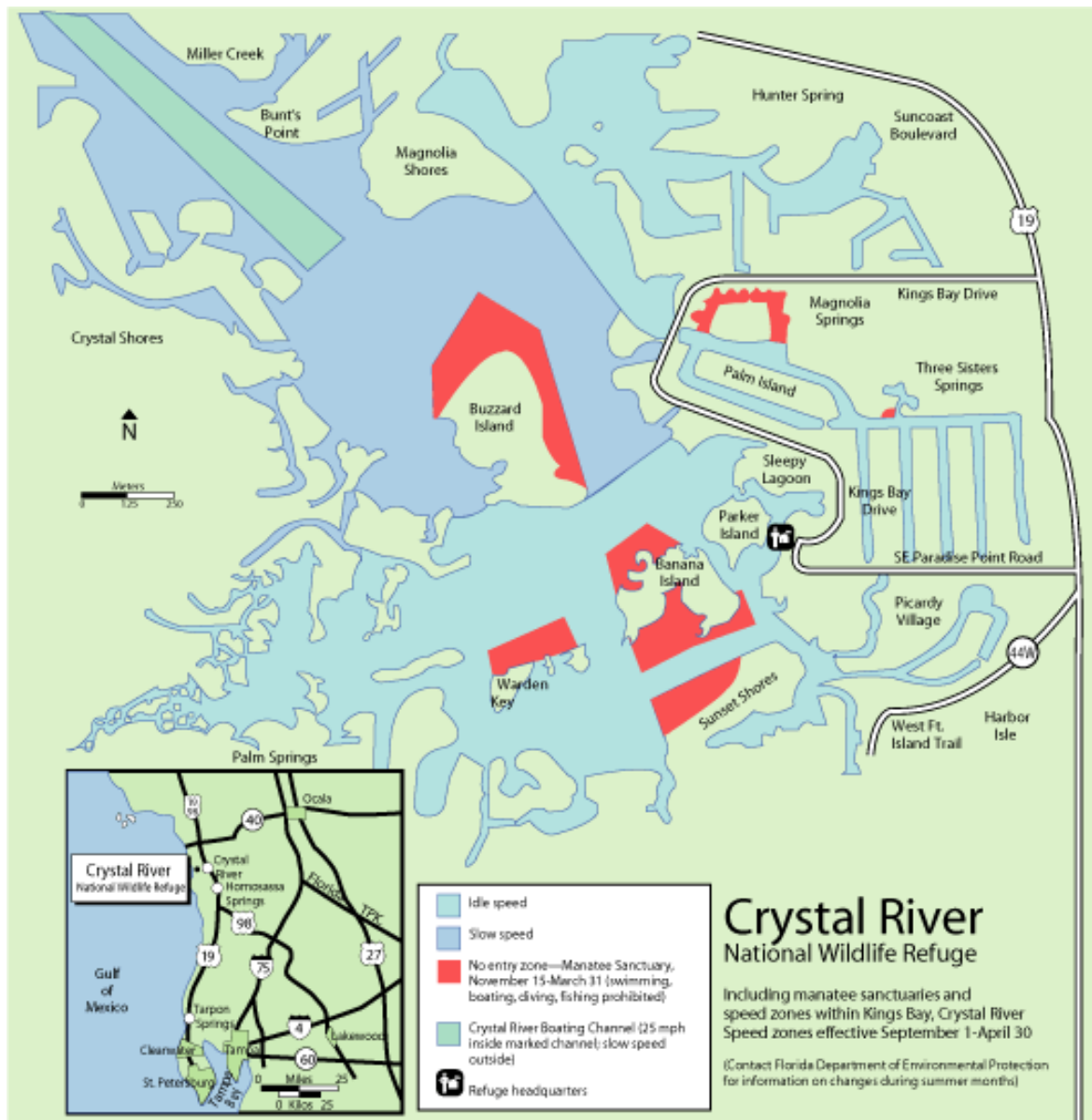
Species	Determination			Response Requested
	No Effect/ No Adverse Modification	Not Likely to Adversely Affect	May Affect	Concur
West Indian manatee	X			

Signature

Date

(Title/office of supervisor at originating station)

Map 1. Location.



XII. Reviewing Ecological Services Office Evaluation:

A. Concurrence ✓ Non-concurrence _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks: None

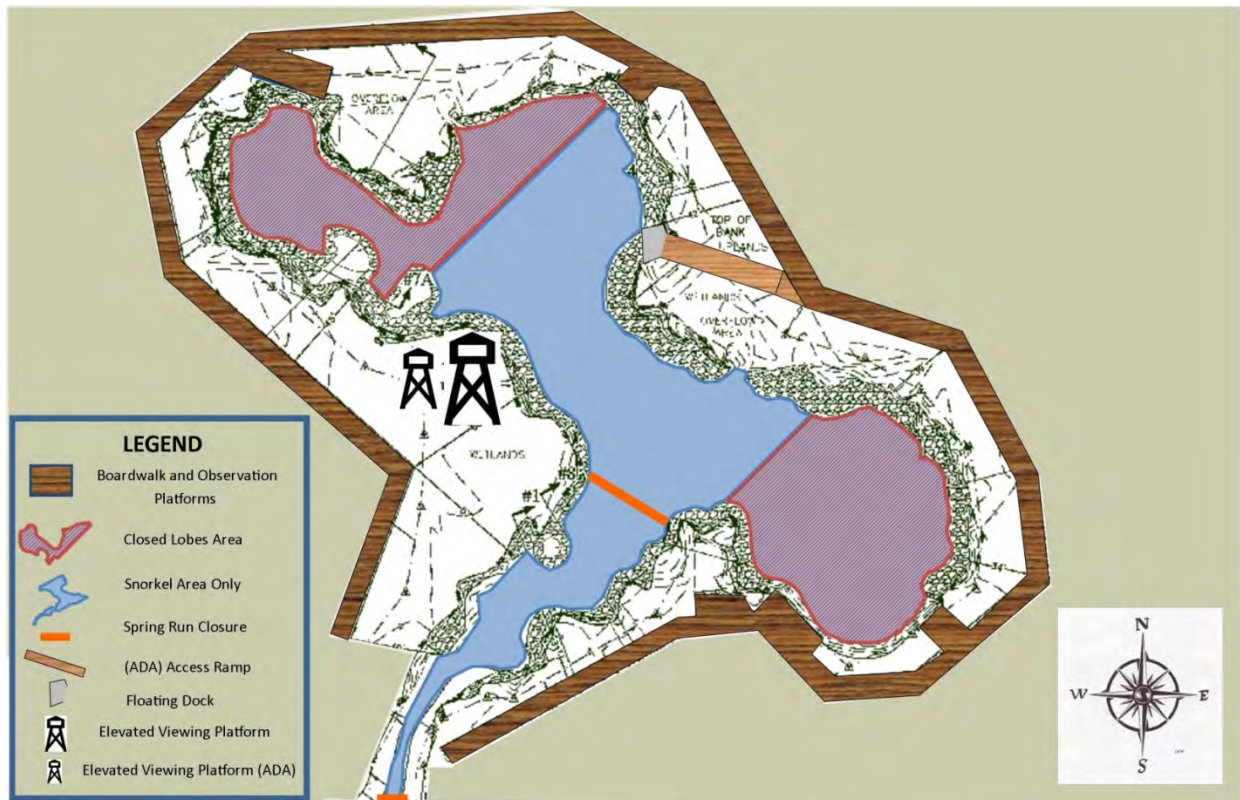

Signature

Jay B. Herrington
Field Supervisor, NFESO

7/6/2015
Date

(Title/office of supervisor at originating station)

Map 2. Proposed no-entry areas within the spring heads in the eastern and western lobes (Pretty Sister and Little Sister, respectively) located on Three Sisters Springs.



Appendix II

Proposed Application Process for Commercial In-water Guiding Services

DRAFT - Proposed Application Process for Commercial In-water Guiding Services, Three Sisters Springs, Crystal River National Wildlife Refuge, Florida

The Refuge is proposing to limit the number and types of in-water uses in Three Sisters Springs during manatee season, and therefore, to restrict the number of Special Use Permits (SUPs) for commercial operations in the Springs. The Refuge is proposing to limit the number of permits to five or less and each permit would limit the number of snorkeling clients in the Springs at any one time to four visitors lead by one USFWS-certified in-water guide; guided tours would be available between the hours of 9AM and 4PM seven days a week from November 15 to March 31, except during emergency closure of the Springs. Commercial in-water guiding services would apply for the available SUPs through the following process.

A panel comprised of Service subject-matter experts (including sustainable wildlife viewing, manatee biology, springs ecology, and community relations) would evaluate all properly completed applications or proposals using scoring factors and guidance developed by the Service for each of the criteria listed below.

- 1) **(Example Draft Form A)** Operation Plan
- 2) **(Example Draft Form B)** Ability to provide guided service to the public.
- 3) **(Example Draft Form C)** Safety Plan, safety training and safety equipment
- 4) **(Example Draft Form D)** History of compliance with state and federal laws, regulations, and permit requirements.

VII. DRAFT INSTRUCTIONS: HOW TO SUBMIT PROPOSALS

All proposals would be submitted in writing to:

Crystal River National Wildlife Refuge

Attention: Andrew Gude

1502 SE Kings Bay Drive

Crystal River, FL 34429

All proposals would be required to be either postmarked or hand delivered to the Fish and Wildlife Service, at the address listed above.

Incomplete proposals would not be returned to the applicant for more information. Materials submitted with the proposals would not be returned to the applicant. All proposals would be required to be legible, either neatly printed in dark ink or typed. **Proposals received after the above deadline would be considered late and would be returned to the sender without evaluation.**

An applicant who knowingly provides false or incomplete information would be disqualified.

Proposals would be required to include:

Cover Sheet. By signing this form the applicant would attest that all information provided with the application is true and complete and authorizes the Service to verify any information provided.

Form A - Proposed Operations Plan.

Form B - Ability to Provide a High Quality Guiding Service to the Public. This form would be used to describe the applicants ability to provide a high quality in-water guiding service.

Form C - Safety plan, safety training and safety equipment.

Form D - History of Violations. Applicants would be required to report any felony conviction, or misdemeanor convictions for violations committed during the last 2 years by the applicant, or any business partners, or employees, and any pending charges pursuant to the instructions on the form. .

VIII. DRAFT INFORMATION REQUIRED

The form instructions would read:

Please read the following forms carefully. Additional information relative to the questions found in these forms can be found in Section V. Be sure to provide, in written form, the information requested under each element in the format specified. **Additional pages should be used if extra space is needed (use copies of or the same format as the continuation sheet form provided in Appendix A).** Information beyond the minimum requested will be evaluated. All information is subject to verification by the Service and additional supporting data may be required. **Be sure to retain a copy of the application for your records.** The Service is under no obligation to return applications or supporting materials.

DRAFT IN-WATER GUIDING PROSPECTUS

APPLICATION COVER SHEET

I certify that the information furnished herewith is true and complete to the best of my knowledge and belief. I authorize the Fish and Wildlife Service to verify the information furnished herewith.

BY _____

(Sign in ink as typed or printed below)

(Type or print full name)

(Doing business as)

PERMANENT MAILING ADDRESS

ADDRESS DURING APPLICATION REVIEW PERIOD (IF DIFFERENT)

TELEPHONE NUMBER: Daytime _____

Other _____

E-mail address (where you would prefer to be contacted) _____

DATE _____

DRAFT FORM A

Proposed Operations Plan

Provide in narrative form a description of the services you propose to offer. This narrative should address, at a minimum, the type and extent of services, including the following:

- 1) Dates of operations:
- 2) Service Offered to Clients:
- 3) Transportation of clients (kpenw kpi "r tqxkukpu"ht"f kucdrf "enkpw):
- 4) Hcekkgu" kpenw kpi "r tqxkukpu"ht"f kucdrf "enkpw+:

Applicant's Name _____ Form A - Page 1

DRAFT FORM B

Ability to Provide a High Quality Guiding Service to the Public

1. Describe your business practices including: proposed client rates; payment options; promotional strategies or efforts; reservation, cancellation and refund policies; and acknowledgement of risk forms.

"

2. "Vgm'wu'j qy "{ qw'gf wecvg" { qwt'en'epw'cdqw'v'j g'Tghwi g."v'j g'Ur t'kpi u."cpf "o cpcv'gg"cpf "
"o cpcv'gg'r tqv'ge'kpu0R'ncug'r tqxkf g'eqpetgv'gzco r'ngu0*ki" { qw'j cxg'etgc'v'gf "gf wecv'k'p'pn""
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"t'ck'p'kpi "v'j cv' { qw'cpf " { qwt'go r'ng { ggul'j cxg't'geg'k'x'gf "v'j cv'k'u't'g'ng'x'cpv'v'q"qr gtc'v'kpi "c'y k'f'rk'g"
"x'kg'y k'pi li w'k'k'pi "dwul'p'guu0"

"

6. "Methods or strategies used to reduce conflicts with other permit holders and/or clients visiting
the Springs.

DRAFT FORM C

Safety plan, safety training, and safety equipment

1. List all safety related training that you, your partners, and your employees have taken (e.g., advanced first aid, ETT, EMT, etc.). Give dates of training or participation and indicate if certification is current (if applicable). **Note: the successful applicant and assistant guides are required to submit current First Aid and CPR certification prior to permit issuance.**
2. Describe any emergency preparedness/procedures you will implement while operating in Three Sisters Springs.
3. List all safety related equipment and supplies you will have available on site.

Applicant's Name _____ Form C - Page 1

DRAFT FORM D

History of Violations, Accidents, and Incidents

1) Since _____, have you, your company, or any of your former, current or proposed business partners or employees that were, are, or will be associated with your guiding business:

- had a nature- or wildlife-guiding privilege suspended or revoked; ____ YES ____ NO
- been administratively penalized for violation of any federal regulations or special use permit [SUP] condition while operating or being associated with a business holding a special use permit from the U.S. Fish and Wildlife Service or any other federal agency; ____ YES ____ NO
- been convicted of violating any state or local laws related to your guiding business? ____ YES ____ NO

Are you or any of your **former, current or proposed business partners** who were, are, or will be associated with your guiding business, under pending charges for any violation associated with guiding or outfitting business on any federal or state lands?

If the answer to any of the above questions is **Yes**, list each incident and give the name of the person, place of occurrence and name/address of the law enforcement agency and/or court involved (you may provide an explanation).

2) Since _____, have any of your **employees** while in your employment **while performing a service for you** under a permit from the U.S. Fish and Wildlife Service or any other federal agency:

- had a guiding privilege suspended or revoked; ____ YES ____ NO
- been administratively penalized for violation of any federal regulations, or special use permit conditions while operating under a special use permit with the U.S. Fish and Wildlife Service or any federal agency; ____ YES ____ NO
- been convicted of for violating any state or local laws related to guiding? ____ YES ____ NO

3) List accidents, incidents, and safety related violations that were required to be reported to any federal, state, or local government [e.g. The U.S. Coast Guard (USCG)] , for all safety violations, accidents and/or incidents involving you or your guiding, outfitting or transporting operation that have occurred since _____.

Note: Any applicant (or applicant who employ individuals), and/or applicant's current or future employees who has a felony conviction, or who has three or more misdemeanor convictions related to providing guiding service within the last five years is ineligible for a permit and/or the USFWS guide certification training.

Applicant's Name _____

CONTINUATION SHEET

Applicant's Name _____ Form _____ Page _____

Appendix III

Monitoring Protocol

Human-Manatee Interaction Monitoring Protocol

Three Sisters Springs

June 29, 2015



Photo Credit to David Schrichte, SUP Photographer

Trisha Phy

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Introduction

Background

Kings Bay is currently the largest wintering site for the Florida manatee (*Trichechus manatus*), a subspecies of the West Indian manatee (*T. m. latirostris*), in the state of Florida. Kings Bay contains over 70 springs that act as thermal refuges for manatees. One specific site, Three Sisters Springs, is composed of three large spring vents. The three major spring vents from east to west are commonly referred to as Pretty Sister, Deep Sister, and Hidden Sister, respectively. The only access point to the interior of Three Sisters Springs consists of a run that is roughly 165-ft long and 17.9-ft wide at the most narrow point. Three Sisters Springs is managed by a multi-agency partnership under the Florida Communities Trust. The City of Crystal River, the U.S. Fish and Wildlife Service, and the Southwest Florida Water Management District collaborate to conserve this crucial wintering site for the Florida manatee.

The increase in manatees utilizing Three Sisters Springs in the winter has been accompanied by an 8% (Vicente, per. comm. 2015) increase in visitors utilizing this same area since 2013. With increased tourism, the spring run is congested with non-motorized vessels and swimmers entering and exiting the springs simultaneously. When manatees are added to this congestion, human-manatee interactions increase. Under certain conditions, over 200 manatees congregate into the less than 2 acre water body of Three Sisters Springs to keep warm, nurse, and rest. The bond between a cow and its calf is very strong and crucial for the survival of the calf, so a special emphasis on cow/calf pairs needs to be studied in Three Sisters Springs (Bonde 2009). Prior to the approval of an Environmental Assessment drafted in February 2015, which proposes to close portions or all of specific spring lobes to control negative human-manatee interactions, refuge management needs to assess manatee use inside Three Sisters Spring on a daily basis. Three Sisters Springs is often closed to human entry for full or partial days to protect manatees from human-caused disturbances but it is also important to quantify and understand the human impacts on manatees during open times. The Florida manatee needs proper protection from human-caused disturbance in Three Sisters Springs while still providing a safe and educational visitor experience in the water and on the boardwalk.

A previous study was done in 1990 to determine manatee distribution as a result of public use in Kings Bay, Crystal River, Florida (Buckingham 1990). Buckingham concluded that manatee distribution was not influenced by public use in Kings Bay because of manatees' critical dependence on the warm springs when the water temperature drops below 68° F (Irvine 1983). Air temperature was not a contributing factor, but it was previously found that 59° F was a trigger temperature for the influx of manatees (Hartman 1974). Buckingham's study was done in a large plot of Kings Bay with sanctuaries for manatees to escape from humans whereas this one will be site-specific in Three Sisters Springs where manatees are confined to a very small area and do not have the option to simply relocate in order to avoid human interaction.

Objectives

This monitoring is being conducted to inform management about the increasing number of interactions occurring between people and manatees and to determine whether Three Sisters Springs is approaching or exceeding a threshold for overcrowding of both manatees and people. The results of this monitoring will be used to determine the best actions regarding the administration of Three Sisters Springs for the 2015-2016 manatee season and beyond. The objectives of this monitoring protocol are as follows.

1. Document human-manatee and human-human interactions occurring in the spring run of Three Sisters Springs
2. Procure unbiased opinion about visitors' experiences inside Three Sisters Springs
3. Compare manatee distribution in Three Sisters Springs in the absence and presence of humans in Three Sisters Springs with special attention given to cow/calf pairs

Sampling Design

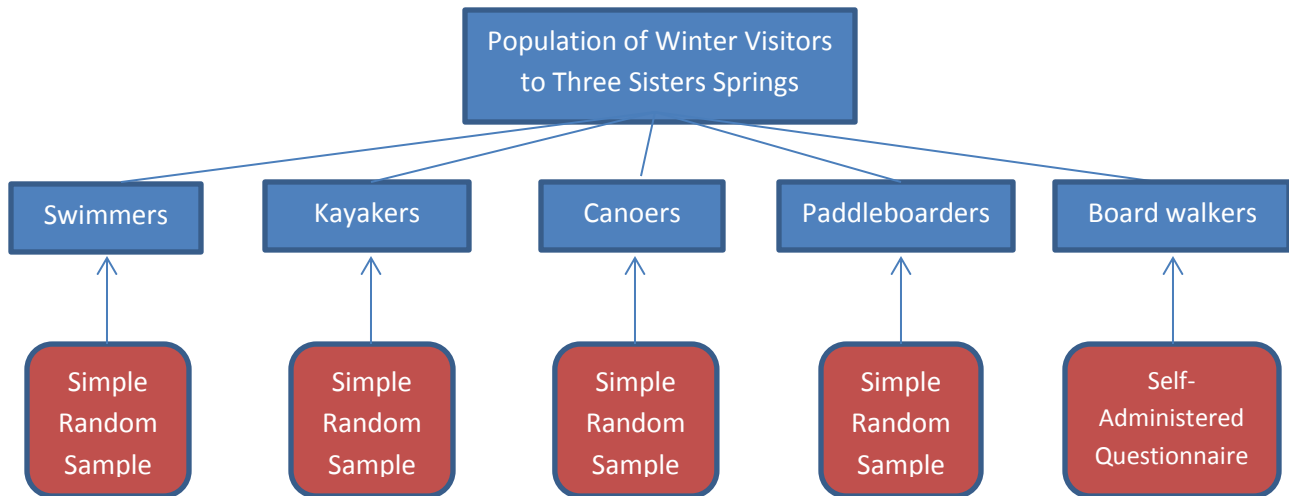
Sample Units and Sample Frame

Areas to be monitored under this protocol are Three Sisters Springs and the associated spring run (Figure 1). Florida manatees within Three Sisters Springs and spring run will be monitored along with in-water visitors and those using the boardwalk during winter months. The sampling unit consists of interactions of manatees and people for the first survey, and spring visitor user groups for the visitor experience survey. For the manatee distribution surveys, the springs are divided in to five sample units, the 1) spring run, 2) west lobe, 3) west lobe closure, 4) middle lobe, and 5) east lobe closure (Figure 2).

Sample Selection and Size

For the human-manatee interaction survey, a sequential sampling method is used to record all interactions in the spring run taking place during the designated sampling time. The minimum sample size expected is five hundred interactions and has been determined to be an adequate sample size for analysis.

A stratified random sample method is used for the visitor experience survey. The five strata represent the distinct user groups of the spring, swimmers, kayakers, canoers, paddleboarders, and boardwalk visitors. A sample size of no fewer than 200 people is required to get a sample that adequately represents the entire population of people visiting the springs throughout the manatee season. Several days of sampling are necessary to get this minimum number of respondents. It is important to note that the visitor survey is voluntary which may affect the results based on the individuals who are willing to respond, but those conducting the survey will make all possible efforts to collect a random and representative sample of the user groups. Figure 3 shows the sampling design.



The boardwalk visitors will not be interviewed by a person, but rather, fill out small questionnaire cards that are placed at the shuttle drop-off/pick-up area so that visitors can fill them out and deposit them into a collection box when they are done. This self-administered, voluntary survey allows for unbiased responses from the public, and consists of the same core questions as the in-water survey. Visitors are asked to fill out the questionnaire upon completion of their visit.

For the manatee distribution survey, manatees will be counted and their location in the springs or spring run recorded at a mid-tide time that occurs during daylight hours. Daylight is necessary to see manatees resting on the bottom. Mid-tide was specifically chosen as the scheduled time because the visibility is clear enough for a confident inventory, and the manatee numbers and distribution are significant enough to record. At high tide, 400 or more manatees have been observed in Three Sisters Springs. Large numbers of manatees stir up the sediment and reduce visibility such that counts done at high tide are not always accurate. At low tide, only a couple, if any, manatees remain in Three Sisters Springs; therefore, recording distribution at low tide is insignificant.

Survey Timing and Schedule

Prior observations have indicated that the tidal cycle has an influence on manatee migration in and out of Three Sisters Springs. Therefore, a sampling period of 30 days was selected to ensure a full tidal cycle was included in the data. Additionally, it is important that the data be collected between November 15 and March 31 because use of the springs by manatees is highest and most critical during the winter months. Manatee numbers in Three Sisters Springs and Kings Bay significantly decrease as the Gulf of Mexico's water temperature increases.

Data is collected on Tuesdays, Thursdays, Saturdays, and Sundays. Two weekdays and two weekend days were chosen to ensure a good representation of visitors over a week. Weekends tend to have larger numbers of visitors than weekdays. Other weekdays were left available in case a sample day needs to be rescheduled. The springs can be closed to in-water visitation due

to manatee activity and other environmental conditions. Data is collected opportunistically on the scheduled days, when the springs are not closed.

Sources of Error

Errors in the data are expected due to natural and anthropogenic causes. Manatee relocation is a possibility during the distribution survey, but their initial resting locations would be recorded. Water visibility can temporarily be reduced by humans kicking with flippers, mating herds, a disturbed manatee trying to move away quickly, or severe weather, which may result in observer error. Another source of observer error occurs when only one person collects interaction data at a time. With a single collector, not every interaction taking place can be recorded over the entire length of the spring run and in the springs themselves. To help correct for this, cameras were put in place in the run to record interactions. Video footage can be viewed later and added to the counts.

Field Methods and Sample Processing

The standard operating procedures (SOPs), included in the Appendix of this protocol, provide detailed instructions on preparation, data collection, data management, and analysis. Creating and using standard procedures like these is essential to the success of a monitoring program. Changes to the protocol or accompanying SOPs should be clearly justified, documented, and dated to ensure their appropriate use in subsequent years.

Pre-survey Logistics and Preparation

A staff schedule was prepared a month in advance, but changes were made accordingly to accommodate impromptu events that prevented a researcher from being available. To ensure consistency among the researchers, each was trained by shadowing the project leader in data collection for each of the three projects prior to the sampling season.

Compliance and Authorization

All personnel provide their own housing and vehicles to travel to the surveying site, and all volunteer service agreements are signed and appropriately filed prior to the start of the research. Three Sisters Springs is managed by the U.S. Fish and Wildlife Service through a partnership with the City of Crystal River and the Southwest Florida Water Management District, so there is full permission to access the site by Refuge staff and volunteers.

Safety Precautions

All reasonable safety measures are taken while conducting the monitoring described in this protocol. The boardwalk where monitoring is being conducted is equipped with safety hand rails. Survey personnel have been instructed about safety precautions pertaining to the survey area around Three Sisters Springs. All personnel are aware of the presence of poison ivy around Three Sisters Springs and know how to identify it. Surveys are not conducted during

thunderstorms or other severe weather conditions. Emergency contact lists are provided to all participants in case of an incident.

Establishing Sampling Units

The beginning third of the spring run (illustrated in Figure 3) was chosen as the sampling unit for the human-manatee interaction survey because it is the narrowest portion of the run which results in the most interactions. This selected portion of the run is easily identifiable by manmade and natural features establishing the boundaries and the layout of the study area.

Swimmers, kayakers, canoers, and paddleboarders are the sample units for the in-water questionnaire and a representative sample of those who visit Three Sisters Springs during the sample period will be included in the survey. Individuals can be part of a private or guided visit to Three Sisters Springs. Visitors can only access the boardwalk through a vendor that provides a shuttle service, called River Ventures, so boardwalk visitors are limited to these individuals and survey respondents will be those who voluntarily fill out the questionnaire provided at a boardwalk kiosk.

The five sampling units used for the manatee distribution survey were chosen to reflect the distinct structural features of the springs and spring run and to include the preferred alternative for future management of the springs which includes two closed areas that manatees can use as a refuge from human activity. Figure 2 illustrates the five sampling units within Three Sisters Springs. Each sampling unit boundary is marked on site for reference with existing landmarks or pink flagging.

Data Collection Procedures

The spring run survey is performed by standing on the boardwalk and recording every interaction that takes place in the specified area. Refer to SOP #1 for complete instructions.

The in-water questionnaire is performed by sitting in a kayak surveying visitors as they exit Three Sisters Springs. Refer to SOP #2 for complete instructions. Refer to SOP #3 for complete instructions for collecting the supplemental data.

The mid-tide count and distribution is performed by recording all manatees' locations in Three Sisters Springs at a designated time. Refer to SOP #4 for complete instructions.

Processing of collected materials

Refuge staff and survey volunteers will collect and manage data to the highest standard possible. Data sheets are stored securely on site until they are moved to the Refuge office at the end of each week where it is checked and entered.

End-of-season Procedures

At the end of the sampling period, data is backed-up on the Crystal River NWR server. Paper data sheets are stored in a folder labeled Intern Research that can be found in the small filing cabinet outside of the biologist's office the in case of future need.

Data Management and Analysis

Data Entry, Verification, and Editing

Data is checked for accuracy and entered on a weekly basis by the Crystal River National Wildlife Refuge interns. The Microsoft Excel spreadsheet forms were previously made by the project leaders, and an intern enters the data directly from the paper data sheets into the Excel spreadsheets. Formatting and formulas are already preset to prevent errors in calculation. Project leaders oversee the progress of the data entry and check for errors.

Metadata

There are eight researchers trained for all three surveys, and their schedules are not consistent each week due to availability. Research meetings occur weekly or even twice a week to discuss progress and revise any issues.

The data fields on the hardcopy Spring Run Interaction data sheet include: date, observer, time, number of vessels in interaction, number of swimmers in interaction, activity, number of manatees in interaction, manatee reaction, and notes. Activities include: collisions, blocking, paddling over manatees, swimming over manatees, and pursuing manatees. Manatee reactions include: engaging in human interaction, left immediate area, left Three Sisters Springs, other, or no reaction.

The data fields on the hardcopy In-water Visitor Experience data sheet include: questioner, date, weather, time, a check box if the visitor refused to participate in the survey, type of visitor, type of visit (guided, non-guided, rental, or private), length of time inside, local or visitor, what did the person like the most and least about their experience, any suggestions to improve their experience, and would they recommend TSS to others. The data fields for Supplemental Data Sheet for Questionnaire include: time (1:00pm, 1:30pm, 2:00pm, 2:30pm, 3:00pm, 3:30pm, and 4:00pm), tide height in inches, number of vessels in TSS, number of swimmers in TSS, number of manatees in TSS, water clarity (1-4), and noise level in decibels using the "Decibel Tenth" app on smartphones. The water clarity has a 1-4 range. 1 is designated as clear with 100%-75% visibility. 2 is designated as slightly cloudy with 74%-50% visibility. 3 is designated as murky with 49%-25% visibility. 4 is designated as no clarity with 24%-0% visibility.

The data fields on the Mid-Tide Counts and Distribution data sheet include: date, mid-tide time, mid-tide height in inches, ambient temperature in Fahrenheit; visibility in the spring run, visibility in the east spring, middle spring, and west spring; number of manatees in the spring run, east lobe closure, middle lobe, west lobe closure, and west lobe; total number of cow/calf pairs, and if Three Sisters Springs is open or closed. The map of Three Sisters Springs used for

distribution plotting includes the following data fields: date, observer, and number of cow/calf pairs. The map has the imaginary lines drawn on it to clearly distinguish the five sampling units.

Data Security and Archiving

Data is stored on the refuge server, backed up on personal drives, and may be saved on ServCat. The location of digital files and archived data sheets is described in the Metadata section of this protocol.

Analysis Methods

Analysis is done using Microsoft Excel. Frequency of interactions, visitor responses, and preferred manatee locations will be determined then displayed graphically. Manatee distribution on open and closed days will be compared using ArcMaps 10.1. Refer to SOP #5 for complete methods.

Software

Microsoft Excel and ArcMaps 10.1 are used for data analysis and data display.

Reporting

After each sampling period is completed, data is analyzed to: 1) determine the frequency and type of human-manatee interaction/conflicts in the spring run; 2) determine what constitutes a quality wildlife viewing experience for visitors, and 3) determine spring habitat usage/preference by manatees during winter months. Results will be summarized annually in a report.

Personnel Requirements and Training

Roles and Responsibilities

If number of days working a week isn't restricted and no other responsibilities are present, a minimum of 5 full-time employees could replicate this survey if they worked four days a week in the field and a day in the office each week. Shift lengths vary depending on what survey is being done and if some shifts overlap. The longest shift would be 4 hours. All researchers are responsible for collaborating to create a monthly schedule following tide charts and data collection.

Qualifications and Training

A bachelor's degree with a year of field experience, whether paid or voluntary, is suggested as background for those participating in these surveys. Survey participants must also have good observation, communication, organization, multi-tasking, and note taking skills. The ability to sit in a kayak and/or stand for 4 hours is also necessary. Schedules vary each day, so flexibility is

required. The necessary training specific to these surveys will be provided by the project leader, so no previous specialized training is required.

Operational Requirements

Budget

A budget of \$5000 was provided to pay for research supplies and daily stipends of \$25 to each qualifying intern and volunteer.

Staff Time and Schedule

A work schedule is designed a month ahead of time. Testing was done prior to the start of the surveys to make the most efficient procedures and schedules. One researcher records spring run interaction for 4 hours (2 hours pre and post mid-tide). The mid-tide count and distribution is done by a second researcher. If the times fall near each other, which they usually do, this second researcher will also fill out the supplementary data sheet for the questionnaire time frame (1pm-4pm). A third researcher is required to conduct the in-water questionnaire from 1pm-4pm in a kayak. The researcher in the kayak has to factor in the time it takes to paddle to and from a launch site to the survey site. Researchers volunteer to cover these shifts, and a schedule is created within a half hour. All personnel receive a schedule, and it is also posted in the office.

Coordination

Data collection was coordinated among all the researchers for the three-part study. Researchers coordinated with refuge staff and FWS volunteers on a daily basis concerning scheduling, survey protocols, data collection, and modifications to data collection.

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Irvine, A. B. 1983. Manatee metabolism and its influence on distribution in Florida. Biol. Conserv. 25:315-334.

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Appendix



Figure 1. Survey Site Location

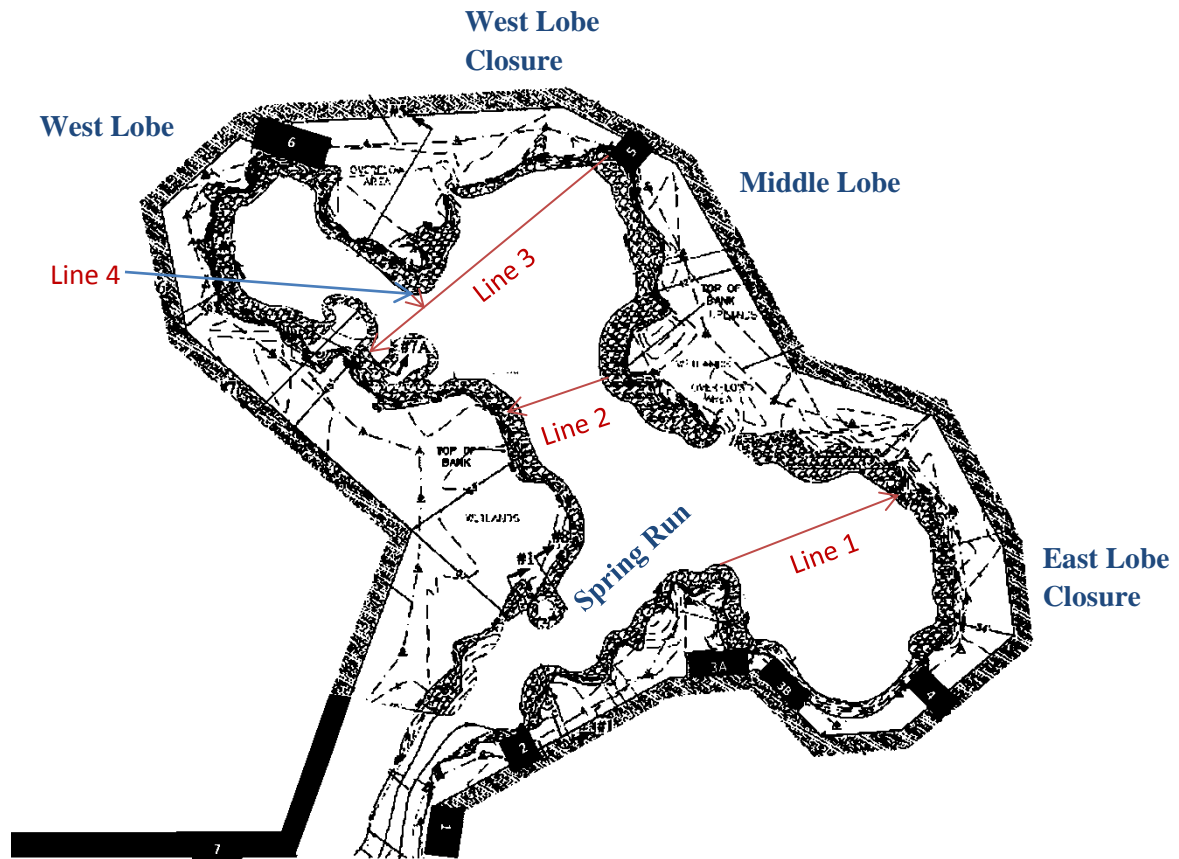


Figure 2. Five Sampling Units for Manatee Distribution within Three Sisters Springs

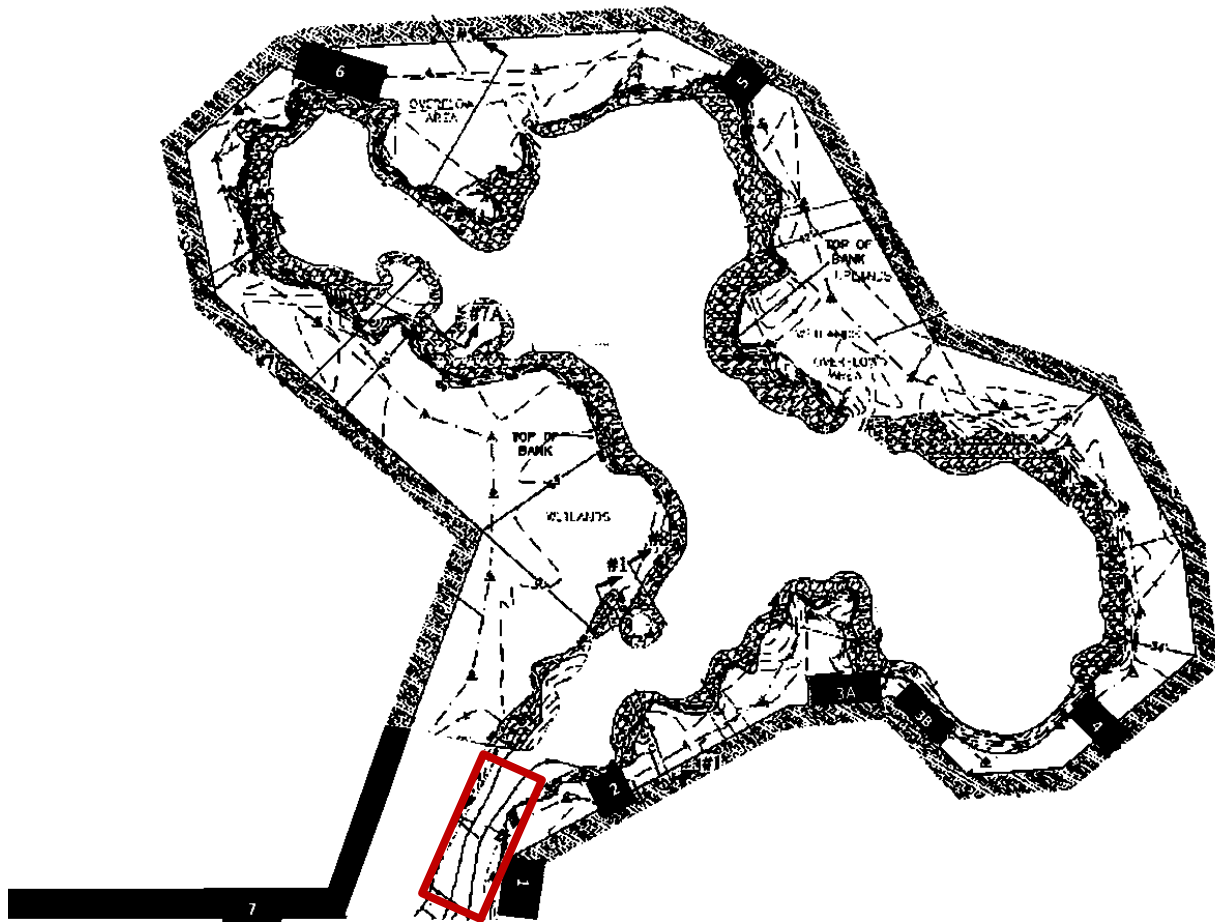


Figure 3. Study Area for Spring Run Interactions

SOP #1: Spring Run Interactions Field Method

Supplies

Binoculars, two meter sticks, zip ties, flat-nosed pliers, clipboard, pencils, stack of “Spring Run Interactions” datasheets, and a smartphone with “Decibel 10th” downloaded on it are the supplies needed to perform this survey.

Installing the Tide Meter

Beforehand, the two meter sticks need to be installed in the spring run on a piling at the entrance. It is best if the meter sticks are secured with at least ten zip ties to the piling closest to and facing the boardwalk where the observer stands. Start with the bottom meter stick, place it vertically against the piling and have it rest on the bottom sediment of the spring run. Secure a zip tie around the top and bottom of the meter stick, and secure more zip ties in-between until the meter stick is immobile. The second meter stick is placed vertically on top of the first meter stick; their edges should touch. Again, secure a zip tie around the top and bottom of the meter stick, and secure more zip ties in-between until the meter stick is immobile. Use the flat-nosed pliers to pull all the zip ties as tight as possible.

The bottom is sandy in the spring run, so the bottom meter stick needs to be monitored over the course of the study in case it sinks into the sand. If the meter stick does sink, it is easy to realign against the bottom edge of the top meter stick. Two meter sticks were sufficient height for the highest tides. Use another meter stick if necessary.

Procedure

1. Observer arrives at Three Sisters Springs with all the supplies except the clipboard. The clipboard filled with datasheets and pencils are stored in a box on-site.
2. Walk left to the south end of the boardwalk.
3. Stand just to the right of the piling.
4. Record the tide from the meter sticks using the binoculars.
5. Use the Decibel 10th app to take a noise reading and record it on the datasheet.
6. Record the tide and noise level every half hour thereafter.
7. Closely observe all activity in the spring run for the next four hours.
8. The datasheet is coded with a letter(s) so that every interaction and response can be circled, and extra space is left for notes.
9. Record every interaction observed that is listed on the datasheet and the time it occurred. Also, record how many swimmers, vessels, and manatees were involved. If a manatee was involved in the interaction, record how the manatee responded.
10. After four hours, store the completed datasheets into the appropriate “completed” section of the clipboard. Store the pencils in the clipboard also.
11. Put the clipboard in the storage box on-site.
12. All completed datasheets will be collected at the end of the week, restocked, and returned to the storage box.

SOP #2: In-Water Questionnaire Field Methods

Supplies

A kayak, paddle, lifejacket, clipboard, pencils, watch/phone, and “In-Water Questionnaire for Swimmers” and “In-Water Questionnaire for Vessels” datasheets are the necessary supplies to perform the questionnaires.

Procedure

1. Carry kayak and paddle to the dock and place in water.
2. Put all equipment inside kayak first before you get in the kayak.
3. Paddle to Three Sisters Springs and linger outside the entrance in the main canal by 1:00 P.M.
4. Randomly select a swimmer or paddler as they exit Three Sisters Springs.*
5. Identify yourself and ask if they'd like to participate in a quick, public survey.
6. If the person rejects, record this as a refusal on the datasheet along with the time. Record if it was a swimmer or paddler and what category they fell in (private, rental, or guided). A key can be found on the datasheet to correctly letter code the datasheet.
7. If the person accepts, ask the questions in sequential order and record their responses in the appropriate columns on the datasheet.
8. Afterwards, thank them for their time and responses.
9. Repeat this process of randomly selecting swimmers and paddlers to survey until 4 P.M. Set a goal to survey at least 20 people per shift, but survey continuously if possible to maximize responses.
10. Paddle back to your launch location and store equipment appropriately. Completed questionnaires are to be filed in the “completed” section of the clipboard. Pencils are stored in the clipboard as well.
11. All completed datasheets will be collected at the end of the week, restocked, and returned to the storage box.

*After paddlecrafts were banned from Three Sisters Springs, two separate questionnaires had to be created for swimmers and paddlers. Follow the same procedure, but use the two different datasheets to record swimmers' and paddlers' responses separately. Paddlers will not be exiting Three Sisters Springs, but they will be paddling by your location. This is the appropriate time to ask if they'd like to participate in a public survey.

SOP #3: Supplemental Data Field Methods

Supplies

Clipboard, pencils, a “Supplemental Data” datasheet, thermometer, binoculars, tide meter, and a smartphone with “Decibel 10th” downloaded on it are the necessary supplies to collect the supplemental data.

Procedure

1. Observer arrives at Three Sisters Springs before 1:00 P.M. and collects the clipboard and pencils from the storage box on-site.
2. Walk left to the south end of the boardwalk.
3. At 1:00 P.M., use the binoculars to take a tide reading from the meter sticks on the piling. Record on the “Supplemental Datasheet”.
4. Now, starting at the piling, walk along the spring run on the boardwalk tallying swimmers, vessels, and manatees.
5. Once you arrive at the next viewing platform, tally the swimmers, vessels, and manatees in the east spring.
6. Continue along the boardwalk. The next two viewing platforms also overlook the east spring. Manatees can be hard to see across the water from one location. Utilize these other viewing platforms to tally all manatees in the east spring.
7. Here at the east spring, use the Decibel Tenth app to take then record a noise level reading.
8. Additionally, record the water clarity at the east spring using the 1-4 water clarity scale.
9. Walking should be done swiftly to avoid double counting people or manatees as they move. This whole count can be done accurately within five minutes.
10. Continue along the boardwalk to the middle spring and stop at the viewing platform.
11. Tally all swimmers, vessels, and manatees.
12. Continuing walking to the west spring and stop at the viewing platform.
13. Tally all swimmers, vessels, and manatees.
14. Another view of the west spring can be found around the corner. Use this view to check for manatees you couldn't see from the other view.
15. Once you are done here, return back to the spring run entrance by the piling.
16. Repeat this process every half hour including at 4:00 P.M.
17. After all data is tallied and recorded, file the completed datasheets into the “completed” section of the clipboard. Pencils are stored in the clipboard also.
18. Put the clipboard back in the storage box on-site.
19. All completed datasheets will be collected at the end of the week, restocked, and returned to the storage box.

SOP #4: Manatee Distribution Field Methods

Supplies

Pink flagging, clipboard, “Mid-tide Manatee Distribution Map” and “Three Sisters Springs Manatee Counts and Distribution” datasheets, pencil, thermometer, binoculars, and tide meter are necessary to record the manatee distribution.

Mid-tide is found using a website called willyweather.com with Bagley Cove, Florida as the closest location to Three Sisters Springs.

Delineating the Sample Units

Refer to Figure 2 for a visual. You will only need the pink flagging for this portion.

Line 1:

Find the tree with a camera on it where the spring run meets the edge of the east spring. Tie the pink flagging around the tree at eye level. Directly across the water is a National Wildlife Refuge (NWR) sign. Walk around the land to tie pink flagging on the post of this sign.

Line 2:

Walk around the land and tie pink flagging on the post of the NWR sign next to the middle spring. Across from it stands a dead maple tree. Walk to the south area between the spring run and the far side of the middle spring. Tie pink flagging around the dead maple tree at eye level that stands across from the NWR sign on the opposite shore.

Line 3:

The western most edge of the viewing platform that overlooks the middle spring is used as a landmark. Pink flagging is not necessary here. Across from the western edge of the viewing platform stands another NWR sign. From the dead maple tree you just marked, walk west and tie pink flagging to the NWR post being referred to.

Line 4:

Walk around the land and locate the tip of land separates the middle spring from the west spring. Then, tie pink flagging to the tree that overhangs the water on this tip of land.

Procedure

1. Arrive at Three Sisters Springs and collect the clipboard with pencils from the storage box.
2. Enter the boardwalk and follow it left to the south end.
3. Start here and record the date and time, air temperature on the thermometer, and water level reading on the tide meter attached to the pilings in the spring run.
4. While walking north along the spring run, count the manatees, cow/calf pairs.
5. Indicate their locations on the datasheet map by shading with the pencil where the manatees are located at that instant.
6. Draw X's where cow/calf pairs are located at the instant.
7. Note the degree of visibility in the spring run using the 1-4 water clarity scale.
8. Keep following the boardwalk around to the east spring.
9. There are several viewing platforms to view all angles of the springs. It may be easier to break the spring up into four imaginary quadrants to help keep track of your count.
10. "East lobe closure" and more "spring run" data are collected here.
11. Count and record the manatee and cow/calf pairs.
12. Sketch their locations on the map provided.
13. Draw X's where cow/calf pairs are located.
14. Record the degree of visibility of the entire east spring (ignoring the designated sample unit lines) using the 1-4 water clarity scale.
15. Once done here, follow the boardwalk around to the middle spring viewing platform.
16. From here the "middle lobe" and "west lobe closure" data are collected.
17. Break the spring up into four imaginary quadrants to help count.
18. Count and record manatee and cow/calf pairs.
19. Sketch their locations on the map.
20. Draw X's where cow/calf pairs are located.
21. Record the water clarity of the middle spring overall (ignoring the designated sample unit lines).
22. Finally, continue to walk around the boardwalk to the last spring, "west spring".
23. This spring is quite small compared to the others, but if need be, break the spring up into imaginary quadrants again.
24. Count and record manatee and cow/calf pairs.
25. Sketch their locations on the map.
26. Draw X's where cow/calf pairs are located.
27. There is a blind spot across the way between some islands. To view this area, access the land and be careful of the poison ivy.
28. Record the water clarity of the west spring.
29. Once you are done, file the completed datasheet into the "completed" section of the clipboard. Put the pencil in the clipboard also.
30. Put the clipboard back in the storage box on-site.
31. All completed datasheets will be collected at the end of the week, restocked, and returned to the storage box.

SOP #5: Analysis Methods

Spring Run Interactions

Frequency of swimmer activities, vessel activities, and manatees' reactions to those interactions will be calculated. For every observed interaction, the activity (represented by a 1) will be multiplied by the number of swimmers involved to calculate the frequency of swimmer interactions. Likewise, the activity (represented by a 1) will be multiplied by the number of vessels involved to calculate the frequency of vessel interactions. Manatees' reactions will be multiplied by the number of manatees involved in the interaction.

Set Up

1. Create a Microsoft Excel spreadsheet.
2. Across the bottom, create a new sheet for every sample day and name it by sample date.
3. Across the top in separate columns, create "Time", "# Vessels", "# Swimmers", "Activity", "# Manatees", "Manatee Reaction", "Notes", and "PDF" headings.
4. Each row represents a different time an interaction was recorded.
5. Use this format for every sample day's sheet.
6. Digitally scan and save the hard copy of the datasheet as a PDF file.
7. Insert a hyperlink to that datasheet under the "PDF" heading.
8. Insert a small table for tide and noise from the half hour readings.
9. Insert a double lined line graph on the side linked to the tide and noise table.
10. Add a "Totals Table" at the bottom of the sheet for total frequencies of all activities and reactions of the sample day.
11. Intern enters data into this spreadsheet.

Analysis

1. For each row, set up a formula to have the number of swimmers multiplied by each activity (some interactions had several activities happening at once i.e. a group of swimmers were walking, one stopped to fix their snorkel, a kayak paddling behind them couldn't stop in time, and the kayak collided with the swimmer).
2. Do the same for the number of vessels.
3. For manatee reactions, set up a formula to have the reaction(s) be multiplied by the number of manatees involved.
4. Create a formula to sum all these and send them to the Totals Table at the bottom of the sheet.
5. This needs to be done for every row on every sheet.
6. Designate a new sheet as a place to create charts and graphs.
7. Create a Totals Table for a sum of all sample day frequencies.
8. Charts and graphs can be created from these frequency totals.

In-Water Questionnaire

All responses were recorded then common responses were grouped by category. Those not fitting into categories were put into “Other”. Three different time frames were chosen to determine how visitors’ responses changed with the rule changes in Three Sisters Springs. Swimmer and vessel responses were separated to compare.

Set Up

1. Create a new Microsoft Excel spreadsheet.
2. Across the bottom, create a new sheet for three time frames.
3. Label them “Feb 3- Feb 28”, “March 1- March 10”, and “March 11- March 31”.
4. Created the following headings on all three sheets:
 - a. Date
 - b. No.
 - c. Time
 - d. Refusal
 - e. Type of Visitor with subheadings Swimmer, Kayaker, Canoeer, and Paddleboarder underneath
 - f. Type of Visit with subheadings Guided, Non-guided, Rental, and Private underneath
 - g. Length of Time Inside (min)
 - h. Local
 - i. Visitor
 - j. Liked Best with subheadings of common response categories underneath
 - k. Liked Least with subheadings of common response categories underneath
 - l. Suggestions to Improve with subheadings of common response categories underneath
 - m. Recommend to Others with subheadings Yes or No
5. On the March 11- March 31 sheet, some alterations need to be done to accommodate the separate questionnaire for paddlers. In a separate section of the same sheet (either below or beside), create all the same headings minus Swimmers and Length of Time Inside.
6. Each row represents an individual questionnaire
7. Intern enters data into this spreadsheet.

Analysis

1. Each column needs to be summed.
2. These sums can be used to make charts and graphs to compare different time frames or compare swimmer responses versus paddler responses.

Manatee Distribution

Identify the most preferred resting areas for manatees in Three Sisters Springs and compare their distribution on open days versus closed days.

Set Up

1. Create a new Microsoft Excel spreadsheet.
2. Create two separate tables (Open Days and Closed Days) that replicate the datasheet.
3. Create a totals column.
4. Intern enters the data here.
5. Open ArcMap 10.1
6. Create a new map.
7. Add a new basemap. Choose World Imagery.
8. Add data using the “Mid-tide Manatee Distribution Map” as a jpg.
9. Georeference the jpg. image to the basemap using control points.
10. Set the coordinate system to Albers Conical Equal Area (Florida Geographic Data Library).
11. Update the georeferencing once layers are lined up.
12. Create a shapefile of the inside of Three Sisters Springs.
13. Create a polygon feature, place the points, and finish sketch.
14. Create a new shapefile for the sample units.
15. Create a polygon feature.
16. Sketch each sample unit using the snap to edge tool, finish each sample unit, and then finish sketch once all are finished.
17. This will specifically be used to separate open days and closed days.
18. Polygons will be freehanded and copied from the pencil sketches on the datasheet maps by sample day. Name layer accordingly.
19. Cow/calf pairs will be point shapefiles added by date of sample day. Name shapefile accordingly.

Analysis

1. Insert the Microsoft Excel spreadsheet made earlier into the attribute table. This will specifically be used to separate open days and closed days.
2. Pull up the properties menu of the polygon manatee distribution layer that was freehanded in.
3. Select the dropdown menu under “Value Field”, and select “Status”. Click on “Add All Values” and apply. This will separate open days and closed days.
4. Change the colors of the open days and closed days to desired contrasting colors.
5. Changing the transparency of one of the layers (depending on color choice) helps to compare manatee distribution on open days versus closed days.
6. Add all cow/calf pair shapefiles.
7. Save this map. It shows manatee distribution on both open and closed days with all cow/calf pair locations.

8. Bright colored circles can be added to highlight the most popular locations for manatees and cow calf pairs in Three Sisters Springs.
9. Now, remove any closed day data including cow/calf pairs.
10. Save this map. It shows manatee and cow/calf pair distribution on only open days.
11. Add any closed day data back and remove open day data.
12. Save this map. It shows manatee and cow/calf distribution on only closed days.
13. The Microsoft Excel spreadsheet can also create charts and graphs to compare the preferred locations of manatees in Three Sisters Springs.

Appendix IV

In-Water Guide Selection and Certification Process

DRAFT

Three Sisters Springs In-Water Guide Selection and Certification Proposed Process, November 15, 2015 – March 31, 2016

Three Sisters Springs Guides Requirements and Certification Process

The Refuge has determined that in order to limit the number and types of in-water uses, it must restrict the number of Special Use Permits (SUPs) which will allow commercial operations in the Springs.

The Refuge is proposing to limit the number of issued permits to five or less for commercial in-water guiding services. Each issued permit will limit the number of in-water guides at one time in the springs to no more than one guide per snorkeling group. Each permit will also limit the number of snorkeling clients in the springs at any one time to four or less visitors per guide, per permitted company, between the hours of 9AM and 4PM, seven days a week from November 15 to March 31, except during emergency closure of the Springs. Additionally, selected commercial permit holders may also separately guide commercial photography and filming permit holders at a ratio of one guide per photographer/videographers.

Each selected SUP holder will nominate a maximum of 5 individuals to attend the USFWS Three Sisters Springs Guide Course in order to become a certified professional USFWS guide. Guides will be expected to educate and escort a maximum of 4 in-water snorkelers (visitors) in the springs at any given time and of one guide per photographer/videographer. An additional 10 slots will be opened via a lottery to current tour operators. The 10 additional trained guides will serve as back up available guides for any of the five SUP holders, in case any of their five selected guides become unavailable throughout the season. During the manatee pre-season SUP coordination meeting (September), interested parties can apply for a random drawing for the additional 10 available slots which would be drawn at the end of the meeting.

SUP-holder requirements

Prior to taking clients into Three Sisters Spring, the guides would be required to have:

- Available commercial space for guides to orient customers including display of “Manatee Manners” video, and, storage to provide all snorkel equipment for visitors;
- Available stock to provide proper snorkel attire and equipment for themselves and their customers in accordance with Standards of Conduct for their in-water experience (see Appendix VI)

USFWS Requirements

The USFWS would require that:

- All guides have:
 - a) Current Dive Master Certification
 - b) At least one year of previous guide experience in Kings Bay or Crystal River waters
 - c) In-water group management training or shadow sessions with most experience guides or greater than 2 years of experience.
 - d) Their contact information and current guides' paperwork kept on file at the Refuge office
- All guides provide a comprehensive safety and manatee awareness orientation for all clients prior to entering the water. The safety orientation will comply with water safety industry standards. The manatee awareness orientation will comply with both: guide training and all USFWS rules and regulations, including 'Manatee Manners'.

USFWS Three Sisters Springs Guide Certification Course components:

I – Basics of the US Fish and Wildlife Service and the National Wildlife Refuge System history and role:

II – Basics of Crystal River National Wildlife Refuge, the Kings Bay Manatee Protection Area and the Manatee Sanctuaries within Kings Bay:

III – Basics of Three Sisters Springs:

IV – Manatee populations:

V – Manatee facts:

VI – Identification of manatees in distress and who to notify:

- i) In-water assist contact protocol and USFWS in-water assist/aiding training (e.g. hook/barb removal, entanglements, etc...)

Each Guide must attend the USFWS Guide Certification Course and pass a review test using the provided handbook with a score of 85% or higher annually.

The USFWS will provide a manual of the topics covered in this course.

** All USFWS sanctioned guides may be required to undergo a background investigation/security clearance as per Department of Interior policy

Appendix V

Proposed Lottery System for Commercial Photographers and Videographers

DRAFT - Proposed Lottery System for Commercial Photography and Filming, in Three Sisters Spring, Crystal River National Wildlife Refuge, Florida

Note: This process and the following restrictions and requirements may not apply to Commercial photographers/videographers/filmmakers working with or for the Service and or its' partners in support of Refuge mission and goals.

During the 2013-2014 manatee viewing season, the Crystal River National Wildlife Refuge (the Refuge) issued SUPs [special use permits] to 29 commercial photographers and 12 film companies to operate in-water in Three Sisters Springs (the Springs). Similarly, during the 2014-2015 manatee viewing season, the Refuge issued 31 commercial photography and 8 commercial filming permits. Under this updated limited access alternative, the number of commercial photographers and commercial film company permits would be reduced thereby reducing the total number of commercial photographers/videographers in the Springs at any one time; the total number would be limited to two or less photographers/videographers/filmmakers. Moving forward, this permitted number would be monitored to better understand any impacts on resting and nursing manatees, and the monitoring results would inform future management decisions regarding increasing or decreasing the number of permits, seasonally.

The Refuge is proposing the implementation of a lottery style system which would require commercial photographers and film companies to submit an application, during an open application period, for the opportunity to operate in the Springs. Permits would be issued for a one week period at 3-4 hour intervals per day (from 8AM to 12PM or 1PM to 5PM on Monday, Tuesday, Wednesday, and Thursday and from 10AM to 1PM or 1PM to 4PM Friday, Saturday, and Sunday) and applicants would have the option to request a maximum of two consecutive weeks per viewing season. A week, in this context, runs from Sunday through Saturday.

Applications would be selected by a random drawing on a specific date/time and the application drawn first would receive a permit for the first available slot requested. The application drawn second would receive a permit for the requested slot and if the requested slot is no longer available, the second choice of date/time would then assigned. This process would continue until either all slots are assigned during the manatee viewing season or the number of applications containing date requests was exhausted. The lottery form used in this process would have a minimum of four slots with an additional option of accepting a date closest to any time requested in the application (priority order of choices would be considered). Applicants would have at least 14 days after selection to accept, in writing, and submit required paperwork and payment for their assigned date. Any open dates/times would be opened for a second application period and drawn on the same procedures as the initial lottery.

The Refuge proposes to provide access to Three Sisters Springs to a limited number of commercial photographers and film companies during the manatee viewing season. In-water

access would be available for this use for 3-4 hour periods per day (from 8AM to 12PM or 1PM to 5PM on Monday, Tuesday, Wednesday, and Thursday and from 9AM to 12PM or 1PM to 4PM Friday, Saturday, and Sunday). Access would be restricted Friday through Sunday for all in-water use to respect the experience of those visitors viewing manatees via the Three Sisters Springs boardwalk.

To gain access to any Refuge closed areas, whether temporary or permanent, commercial photographers and commercial film companies would be required apply for an additional Special Use Permit from the Crystal River NWR. In addition, these permit holders would be required to be accompanied by a USFWS certified in-water guide (with current training and in good standing). The guide would be required to provide a complete orientation and would help ensure that photographic activities would not disturb resting or nursing manatees.

Permit holders would be required to wear a Refuge supplied numbered SUP vest at all times while on Refuge property, in the water, and/or while filming or taking photographs. Permit holders wearing these vests would be granted special access to areas that are closed to the general public at the discretion of Refuge staff, as per above (see information under fees in this section).

Holders of these commercial photography and commercial filming permits would also be allowed to use the in-water visitor area designated for wildlife viewing via snorkeling. In addition, these permit holders would be allowed to break the water service to capture images provided they were not within six feet of a resting or nursing manatee and provided all standards of conduct were followed, along with adherence to the 12 prohibitions.

The Refuge recognizes that this process may be potentially both time consuming and labor intensive. The Refuge estimates the administrative costs of implementing this program to be approximately \$6,555. This cost includes the implementation of a lottery system and additional monitoring of the closed lobes.

Fees

In an effort to recoup some costs associated with operating this program, a fee for obtaining a commercial photography and commercial filming Special Use Permits would be \$300. This fee would not include the cost for services of a required in-water certified USFWS guide necessary when accessing the Springs.

Sample Application Form

Name: _____

Mailing Address: _____

Area Code /Phone Number: _____

E-mail: _____

Date/ Time Choice (example Dec. 13-19/AM)

1st Choice: _____

2nd Choice: _____

3rd Choice: _____

4th Choice: _____

Mail To:

Crystal River NWR
Attn: Photography Lottery
1502 SE Kings Bay Drive
Crystal River, FL 34429

One application per photographer. All Applications must be received by COB August 25, 2015.

Appendix VI

Proposed Standards of Conduct

DRAFT

PROPOSED STANDARDS OF CONDUCT
for
THREE SISTERS SPRINGS
From November 15 – March 31

General Standards of Conduct

- No disposable single-use plastic or paper containers or other disposable items
- No glass bottles
- No alcoholic beverages
- No vessels (motorized or non-motorized) including but not limited to motorized propelled devices and underwater scooters
- No fishing, gigging, spearing, netting
- No loud noises (including but limited to yelling, screaming, or music), or splashing or diving
- No standing on, holding, climbing, or hanging from vegetation
- No removal of any plant, animal, mineral, or other natural or cultural resource
- Refuge visitors are required to remove all trash and food products from water and/or property
- No food or drink (water) is to be made available to wildlife
- No scuba diving
- No attaching to or altering of any structures, vegetation, or land; apart from designated mooring(s)
- No phone or camera extension poles allowed
- No exchanging of items or any materials between in water visitors and boardwalk visitors including throwing, passing, or handing items between visitors.
- No remote control equipment (boats, UAVs, planes, submarines, cameras) is allowed
- No pets are allowed inside Three Sisters Springs or on the boardwalk
- No dissemination of non-approved information (advertising, flyers, handouts, etc.)
- No commerce or solicitation of products or services apart from approved, current SUPs

Wildlife Snorkeling/Viewing Standards of Conduct

- A professional USFWS-certified guide (certified under the USFWS Three Sisters Springs Guide Course) must be in-water with clients at all times
- The USFWS Three Sisters Springs Guide Certification course and test must be passed annually
- Guides will provide a comprehensive safety, expectations of conduct, and manatee awareness orientation for all clients prior to entering the water; the safety orientation will comply with water safety industry standards and manatee awareness and expectations of

conduct orientation will comply with both guide training and USFWS rules and regulations including 'Manatee Manners'

- It is the responsibility of the SUP-holder to ensure their clients can snorkel calmly and efficiently without disturbing manatees or other wildlife
- Guide to client ratio for in-water refuge activities will be 1:4 or less
- Guides and clients are required to wear a wetsuit, mask and snorkel while in the water at Three Sisters Springs;
- For additional buoyancy, guides and clients may use snorkel vests
- Guides' and clients' snorkel equipment including wetsuits, snorkel vests, masks, and snorkels should be approximately 90 % black.
- Guides and clients may not use fins
- All children under 16 years old must be supervised by a responsible adult (at least 21 years old) at a 1:1 ratio.
- Guides and clients may only enter and exit the water at approved, marked/signed location(s)
- Communications between guide and clients will mainly consist of hand signals, any verbal communication will be kept at a minimal volume and focus on either snorkeler/swimmer safety or manatee awareness.
- All snorkeling activity will be keep on the surface (no diving below the surface)
- No initiating contact with or pursuing manatees or any other wildlife; any interactions with manatees will comply with 'Manatee Manners'; Keep hands at your side, crossed in front of you, or behind your back.
- Stay at least 6 feet from all manatees unless the manatee initiates approach and interaction (including all resting manatees; manatees rising to the surface for breath; feeding/nursing manatees; and all cow/calf pairs)
- Standing or walking on the bottom of the Springs will only be allowed in cases of emergency
- Any photography or videography that may result in any financial gain is prohibited without a separate, pre-approved commercial photography/filming special use permit [SUP]
- No artificial lighting will be allowed for photography/filming including but not limited to flash, strobe, and diffused lighting

Appendix VII

Species List

Species List for Crystal River NWR; species confirmed at TSS with *

BIRDS

Common Name	Scientific Name
LOONS	
Common Loon	<i>Gavia immer</i>
GREBES	
Pied-billed Grebe*	<i>Podilymbus podiceps</i>
Horned Grebe	<i>Podiceps auritus</i>
Eared Grebe	<i>Podiceps nigricollis</i>
PELICANS	
American White Pelican	<i>Pelecanus erythrorhynchos</i>
Brown Pelican*	<i>Pelecanus occidentalis</i>
CORMORANTS	
Double-crested Cormorant*	<i>Phalacrocorax auritus</i>
DARTERS	
Anhinga*	<i>Anhinga anhinga</i>
FRIGATEBIRDS	
Magnificent Frigatebird	<i>Fregata magnificens</i>
HERONS & BITTERNS	
American Bittern	<i>Botaurus lentiginosus</i>
Least Bittern	<i>Ixobrychus exilis</i>
Great Blue Heron*	<i>Ardea Herodias</i>
Great Egret*	<i>Ardea alba</i>
Snowy Egret*	<i>Egretta thula</i>
Little Blue Heron*	<i>Egretta caerulea</i>
Tricolored Heron*	<i>Egretta tricolor</i>
Reddish Egret	<i>Egretta rufescens</i>
Cattle Egret*	<i>Bubulcus ibis</i>
Green Heron*	<i>Butorides virescens</i>
Black-crowned Night Heron*	<i>Nyctanassa nycticorax</i>

Common Name	Scientific Name
Yellow-crowned Night Heron*	<i>Nyctanassa violacea</i>
STORKS	
Wood Stork*	<i>Mycteria americana</i>
IBISES & SPOONBILLS	
White Ibis*	<i>Eudocimus albus</i>
Glossy Ibis	<i>Plegadis falcinellus</i>
Roseate Spoonbill	<i>Platalea ajaja</i>
SWANS, GEESE & DUCKS	
Snow Goose	<i>Chen caerulescens</i>
Wood Duck	<i>Aix sponsa</i>
Green-winged Teal	<i>Anas crecca</i>
American Black Duck	<i>Anas rubripes</i>
Mottled Duck*	<i>Anas fulvigula</i>
Mallard	<i>Anas platyrhynchos</i>
Northern Pintail	<i>Anas acuta</i>
Blue-winged Teal	<i>Anas discors</i>
Northern Shoveler	<i>Anas clypeata</i>
Gadwall	<i>Anas strepera</i>
American Wigeon	<i>Anas americana</i>
Canvasback	<i>Aythya valisineria</i>
Redhead	<i>Aythya americana</i>
Ring-necked Duck	<i>Aythya collaris</i>
Greater Scaup	<i>Aythya marila</i>
Lesser Scaup	<i>Aythya affinis</i>
Bufflehead*	<i>Bucephala albeola</i>
Hooded Merganser	<i>Lophodytes cucullatus</i>
Red-breasted Merganser	<i>Mergus serrator</i>
Ruddy Duck	<i>Oxyura jamaicensis</i>
Common Goldeneye	<i>Bucephala clangula</i>
Common Merganser	<i>Mergus merganser</i>

Common Name	Scientific Name
VULTURES	
Black Vulture*	<i>Coragyps atratus</i>
Turkey Vulture*	<i>Cathartes aura</i>
HAWKS & KITES	
Osprey*	<i>Pandion haliaetus</i>
Swallow-tailed Kite*	<i>Elanoides forficatus</i>
Bald Eagle*	<i>Haliaeetus leucocephalus</i>
Sharp-shinned Hawk*	<i>Accipiter striatus</i>
Cooper's Hawk*	<i>Accipiter cooperii</i>
Red-shouldered Hawk*	<i>Buteo lineatus</i>
Broad-winged Hawk	<i>Buteo platypterus</i>
Short-tailed Hawk	<i>Buteo brachyurus</i>
Red-tailed Hawk*	<i>Buteo jamaicensis</i>
Northern Harrier*	<i>Circus cyaneus</i>
FALCONS	
American Kestrel*	<i>Falco sparverius</i>
Peregrine Falcon	<i>Falco peregrinus</i>
Merlin	<i>Falco columbarius</i>
TURKEYS & QUAIL	
Wild Turkey	<i>Carduelis tristis</i>
Northern Bobwhite	<i>Colinus virginianus</i>
CRANES & LIMPKINS	
Sandhill Crane*	<i>Grus canadensis</i>
Whooping Crane (reintroduced 2002)	<i>Grus americana</i>
Limpkin	<i>Aramus guarauna</i>
RAILS, GALLINULES, COOTS	
Yellow Rail	<i>Coturnicops noveboracensis</i>
Black Rail	<i>Laterallus jamaicensis</i>
Clapper Rail	<i>Rallus longirostris</i>

Common Name	Scientific Name
King Rail	<i>Rallus elegans</i>
Virginia Rail	<i>Rallus limicola</i>
Sora	<i>Porzana carolina</i>
Common Moorhen*	<i>Gallinula galeata</i>
American Coot*	<i>Fulica americana</i>
OYSTERCATCHERS	
American Oystercatcher	<i>Haematopus palliatus</i>
STILTS & AVOCETS	
Black-necked Stilt	<i>Himantopus mexicanus</i>
American Avocet	<i>Recurvirostra americana</i>
PLOVERS	
Black-bellied Plover	<i>Pluvialis squatarola</i>
Snowy Plover	<i>Charadrius alexandrinus</i>
Wilson's Plover	<i>Charadrius wilsonia</i>
Semipalmated Plover*	<i>Charadrius semipalmatus</i>
Killdeer*	<i>Charadrius vociferus</i>
SANDPIPERS	
Greater Yellowlegs	<i>Tringa melanoleuca</i>
Lesser Yellowlegs*	<i>Tringa flavipes</i>
Solitary Sandpiper	<i>Tringa solitaria</i>
Willet	<i>Tringa semipalmata</i>
Spotted Sandpiper*	<i>Actitis macularia</i>
Whimbrel	<i>Numenius phaeopus</i>
Long-billed Curlew	<i>Numenius americanus</i>
Marbled Godwit	<i>Limosa fedoa</i>
Ruddy Turnstone	<i>Arenaria interpres</i>
Red Knot	<i>Calidris canutus</i>
Sanderling	<i>Calidris alba</i>
Semipalmated Sandpiper	<i>Calidris pusilla</i>
Western Sandpiper	<i>Calidris mauri</i>

Common Name	Scientific Name
Least Sandpiper	<i>Calidris minutilla</i>
Pectoral Sandpiper	<i>Calidris melanotos</i>
Dunlin	<i>Calidris alpina</i>
Stilt Sandpiper	<i>Calidris himantopus</i>
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>
Short-billed Dowitcher	<i>Limnodromus griseus</i>
Wilson's Snipe	<i>Gallinago delicata</i>
Common Snipe*	<i>Gallinago gallinago</i>
American Woodcock	<i>Scolopax minor</i>
GULLS, TERNS & SKIMMERS	
Laughing Gull*	<i>Leucophaeus atricilla</i>
Bonaparte's Gull	<i>Chroicocephalus philadelphia</i>
Ring-billed Gull*	<i>Larus delawarensis</i>
Herring Gull*	<i>Larus argentatus</i>
Caspian Tern	<i>Sterna caspia</i>
Royal Tern*	<i>Thalasseus maximus</i>
Sandwich Tern	<i>Thalasseus sandvicensis</i>
Common Tern	<i>Sterna hirundo</i>
Forster's Tern	<i>Sterna forsteri</i>
Least Tern	<i>Sternula antillarum</i>
Black Tern	<i>Chlidonias niger</i>
Black Skimmer	<i>Rynchops niger</i>
PIGEONS & DOVES	
White-winged Dove	<i>Zenaida asiatica</i>
Mourning Dove*	<i>Zenaida macroura</i>
Common Ground-dove*	<i>Columbina passerina</i>
CUCKOOS	
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Yellow-bellied Cuckoo	<i>Coccyzus americanus</i>
OWLS	

Common Name	Scientific Name
Barn Owl	<i>Tyto alba</i>
Eastern Screech Owl	<i>Otus asio</i>
Great Horned Owl	<i>Bubo virginianus</i>
Barred Owl*	<i>Strix varia</i>
Short-eared Owl	<i>Asio flammeus</i>
GOATSUCKERS	
Common Nighthawk	<i>Chordeiles minor</i>
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>
Eastern Whip-poor-will	<i>Caprimulgus vociferus</i>
SWIFTS	
Chimney Swift	<i>Chaetura pelagica</i>
HUMMINGBIRDS	
Ruby-throated Hummingbird	<i>Archilochus colubris</i>
KINGFISHERS	
Belted Kingfisher*	<i>Megaceryle alcyon</i>
WOODPECKERS	
Red-headed Woodpecker*	<i>Melanerpes erythrocephalus</i>
Red-bellied Woodpecker*	<i>Melanerpes carolinus</i>
Downy Woodpecker	<i>Picoides pubescens</i>
Hairy Woodpecker	<i>Picoides villosus</i>
Northern Flicker	<i>Colaptes auratus</i>
Pileated Woodpecker*	<i>Dryocopus pileatus</i>
Yellow-bellied Sapsucker*	<i>Sphyrapicus varius</i>
FLYCATCHERS	
Eastern Phoebe*	<i>Eastern Phoebe</i>
Great-crested Flycatcher*	<i>Myiarchus crinitus</i>
Eastern Kingbird	<i>Tyrannus tyrannus</i>
Gray Kingbird*	<i>Tyrannus dominicensis</i>
Acadian Flycatcher	<i>Empidonax virescens</i>
Eastern Wood-pewee	<i>Contopus virens</i>

Common Name	Scientific Name
SWALLOWS	
Purple Martin	<i>Progne subis</i>
Tree Swallow	<i>Tachycineta bicolor</i>
Northern Rough-winged Swallow*	<i>Stelgidopteryx serripennis</i>
Bank Swallow	<i>Riparia riparia</i>
Barn Swallow	<i>Hirundo rustica</i>
JAYS & CROWS	
Blue Jay	<i>Cyanocitta cristata</i>
American Crow*	<i>Corvus brachyrhynchos</i>
Fish Crow*	<i>Corvus ossifragus</i>
CHICKADEES & TITMICE	
Black-capped Chickadee*	<i>Parus atricapillus</i>
Carolina Chickadee*	<i>Poecile carolinensis</i>
Tufted Titmouse*	<i>Baeolophus bicolor</i>
NUTHATCHES & CREEPERS	
White-breasted Nuthatch	<i>Sitta carolinensis</i>
Brown-headed Nuthatch	<i>Sitta pusilla</i>
Brown Creeper	<i>Certhia americana</i>
WRENS	
Carolina Wren*	<i>Thryothorus ludovicianus</i>
House Wren*	<i>Troglodytes aedon</i>
Marsh Wren	<i>Cistothorus palustris</i>
Winter Wren	<i>Troglodytes hiemalis</i>
Sedge Wren	<i>Cistothorus platensis</i>
MOCKINGBIRDS & THRASHERS	
Gray Catbird*	<i>Dumetella carolinensis</i>
Northern Mockingbird*	<i>Mimus polyglottos</i>
Brown Thrasher	<i>Toxostoma rufum</i>
THRUSHES	
Eastern Bluebird*	<i>Sialia sialis</i>

Common Name	Scientific Name
Veery	<i>Catharus fuscescens</i>
Gray-cheeked Thrush	<i>Catharus minimus</i>
Swainson's Thrush	<i>Catharus ustulatus</i>
Hermit Thrush	<i>Catharus guttatus</i>
Wood Thrush	<i>Hylocichla mustelina</i>
American Robin*	<i>Turdus migratorius</i>
Louisiana Waterthrush*	<i>Parkesia motacilla</i>
Northern Waterthrush	<i>Parkesia noveboracensis</i>
KINGLETS & GNATCATCHERS	
Golden-crowned Kinglet	<i>Regulus satrapa</i>
Ruby-crowned Kinglet*	<i>Regulus calendula</i>
Blue-gray Gnatcatcher*	<i>Poliophtila caerulea</i>
PIPITS	
American Pipit	<i>Anthus rubescens</i>
WAXWINGS	
Cedar Waxwing*	<i>Bombycilla cedrorum</i>
SHRIKES	
Loggerhead Shrike	<i>Lanius ludovicianus</i>
VIREOS	
White-eyed Vireo	<i>Vireo griseus</i>
Blue-headed Vireo	<i>Vireo solitarius</i>
Yellow-throated Vireo*	<i>Vireo flavifrons</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
WARBLERS	
Blue-winged Warbler	<i>Vermivora pinus</i>
Northern Parula	<i>Parula Americana</i>
Yellow Warbler	<i>Setophaga petechia</i>
Black-throated Blue Warbler	<i>Setophaga caerulescens</i>
Yellow-rumped Warbler*	<i>Setophaga coronata</i>
Yellow-throated Warbler	<i>Setophaga dominica</i>

Common Name	Scientific Name
Pine Warbler	<i>Setophaga pinus</i>
Prairie Warbler	<i>Setophaga discolor</i>
Palm Warbler*	<i>Setophaga palmarum</i>
Black-and-White Warbler*	<i>Mniotilta varia</i>
American Redstart	<i>Setophaga ruticilla</i>
Prothonotary Warbler	<i>Protonotaria citrea</i>
Ovenbird	<i>Seiurus aurocapillus</i>
Common Yellowthroat*	<i>Geothlypis trichas</i>
Black-throated Green Warbler	<i>Setophaga virens</i>
Blackpoll Warbler	<i>Setophaga striata</i>
Cape May Warbler	<i>Setophaga Tigrina</i>
Hooded Warbler	<i>Setophaga citrina</i>
Magnolina Warbler	<i>Setophaga Magnolia</i>
Worm-eating Warbler	<i>Helmitheros Vermivorus</i>
Connecticut Warbler	<i>Oporornis agilis</i>
Orange-crowned Warbler	<i>Oreothlypis celata</i>
Yellow-breasted Chat	<i>Icteria virens</i>
TANAGERS, GROSBEAKS & BUNTINGS	
Summer Tanager	<i>Piranga rubra</i>
Scarlet Tanager	<i>Piranga olivacea</i>
Northern Cardinal*	<i>Cardinalis cardinalis</i>
Blue Grosbeak	<i>Guiraca caerulea</i>
Indigo Bunting	<i>Passerina cyanea</i>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>
Painted Bunting	<i>Passerina ciris</i>
SPARROWS & FINCHES	
Chipping Sparrow*	<i>Spizella passerina</i>
Seaside Sparrow	<i>Ammodramus maritimus</i>
Song Sparrow	<i>Melospiza melodia</i>
Swamp Sparrow	<i>Melospiza georgiana</i>

Common Name	Scientific Name
White-throated Sparrow	<i>Zonotrichia albicollis</i>
Dark-eyed Junco	<i>Junco hyemalis</i>
Bachman's Sparrow	<i>Peucaea aestivalis</i>
Vesper Sparrow	<i>Pooecetes gramineus</i>
Sharp-tailed Sparrow	<i>Ammodramus caudactus</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>
Le Conte's Sparrow	<i>Ammodramus leconteii</i>
Henslow's Sparrow	<i>Ammodramus henslowii</i>
Grasshopper Sparrow	<i>Ammodramus savannarum</i>
Field Sparrow	<i>Spizella pusilla</i>
House Sparrow	<i>Passer domesticus</i>
Eastern Towhee	<i>Pipilo erythrophthalmus</i>
American Goldfinch*	<i>Spinus virginianus</i>
House Finch	<i>Carpodacus mexicanus</i>
BLACKBIRDS & ALLIES	
Bobolink	<i>Dolichonyx oryzivorus</i>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Eastern Meadowlark	<i>Sturnella magna</i>
Boat-tailed Grackle	<i>Quiscalus major</i>
Common Grackle*	<i>Quiscalus quiscula</i>
Brown-headed Cowbird*	<i>Molothrus ater</i>
Baltimore Oriole*	<i>Icterus galbula</i>
Rusty Blackbird	<i>Euphagus carolinus</i>
INTRODUCED NONNATIVE SPECIES	
Muscovy Duck	<i>Cairina moschata</i>
Monk Parakeet*	<i>Myiopsitta monachus</i>
Rock Dove	<i>Columba livia</i>
Eurasian Collared-dove	<i>Streptopelia decaocto</i>
European Starling	<i>Sturnus vulgaris linnaeus</i>
House Sparrow	<i>Passer domesticus</i>

Common Name	Scientific Name
Budgerigar	<i>Melopsittacus undulatus</i>

Mammal List for Crystal River NWR; species found at Three Sisters Springs denoted with *

COMMON NAME	SCIENTIFIC NAME
MAMMALS	
Big brown bat	<i>Eptesicus fuscus</i>
Bobcat*	<i>Lynx rufus</i>
Bottlenose dolphin	<i>Tursiops truncatus</i>
Brazilian free-tailed bat	<i>Tadarida brasiliensis</i>
Common opossum	<i>Didelphis marsupialis</i>
Cotton deermouse	<i>Peromyscus gossypinus</i>
Coyote	<i>Canis latrans</i>
Eastern cottontail	<i>Sylvilagus floridanus</i>
Eastern gray squirrel*	<i>Sciurus carolinensis</i>
Eastern harvest mouse	<i>Reithrodontomys humulis</i>
Eastern mole	<i>Scalopus aquaticus</i>
Eastern pipistrel	<i>Pipistrellus subflavus</i>
Eastern red bat	<i>Lasiurus borealis</i>
Eastern spotted skunk	<i>Spilogale putorius</i>
Eastern woodrat	<i>Neotoma floridana</i>
Evening bat	<i>Nycticeius humeralis</i>
Everglades short-tailed shrew	<i>Blarina peninsulae</i>
Florida black bear	<i>Ursus americanus floridanus</i>
Florida mink	<i>Neovison vison lutensis</i>
Florida mouse	<i>Podomys floridanus</i>
Florida panther	<i>Puma concolor couguar</i>
Fox squirrel	<i>Sciurus niger</i>
Golden mouse	<i>Ochrotomys nuttalli</i>

Mammal List for Crystal River NWR; species found at Three Sisters Springs denoted with *

COMMON NAME	SCIENTIFIC NAME
Gray fox*	<i>Urocyon cinereoargenteus</i>
Hispid cotton rat	<i>Sigmodon hispidus</i>
Hoary bat	<i>Lasiurus cinereus</i>
Homosassa shrew	<i>Sorex longirostris eionis</i>
House mouse	<i>Mus musculus</i>
Long-tailed weasel	<i>Mustela frenata</i>
Marsh rabbit	<i>Sylvilagus (tapeti) palustris</i>
Nine-banded armadillo	<i>Dasypus novemcinctus</i>
Northern yellow bat	<i>Lasiurus intermedius</i>
Northern American least shrew	<i>Cryptotis parva</i>
North American river otter	<i>Lontra canadensis</i>
Pine vole	<i>Microtus pinetorum</i>
Raccoon*	<i>Procyon lotor</i>
Rafinesque's big-eared bat	<i>Corynorhinus rafinesquii</i>
Red fox	<i>Vulpes vulpes</i>
Rice rat	<i>Oryzomys palustris</i>
Seminole bat	<i>Lasiurus seminolus</i>
Southern myotis	<i>Myotis austroriparius</i>
Southeastern pocket gopher	<i>Geomys pinetis</i>
Southeastern shrew	<i>Sorex longirostris</i>
Southern flying squirrel	<i>Glaucomys volans</i>
Striped skunk	<i>Mephitis mephitis</i>
West Indian manatee*	<i>Trichechus manatus</i>
White-tailed deer	<i>Odocoileus virginianus</i>

Mammal List for Crystal River NWR; species found at Three Sisters Springs denoted with *

References:

USFWS. 2012. Chassahowitzka Comprehensive Conservation Plan

Reptile and Amphibian List for Crystal River NWR; species identified at Three Sisters Springs denoted with an *

REPTILES	
<i>TURTLES</i>	
Alligator snapping turtle	<i>Macrochelys temmincki</i>
Green sea turtle	<i>Chelonia mydas</i>
Atlantic hawksbill sea turtle	<i>Eretmochelys imbricata imbricata</i>
Atlantic loggerhead sea turtle	<i>Caretta caretta</i>
Snapping turtle	<i>Chelydra serpentina</i>
Eastern chicken turtle	<i>Dierochelys reticularia</i>
Eastern musk turtle	<i>Sternotherus oddratus</i>
Florida box turtle	<i>Terrapene carolina bauri</i>
Florida mud turtle	<i>Kinosternon subrubrum steindachneri</i>
Florida red-bellied turtle	<i>Pseudemys nelsoni</i>
Florida softshell	<i>Apalone ferox</i>
Gopher tortoise	<i>Gopherus polyphemus</i>
Gulf Coast box turtle	<i>Terrapene carolina major</i>
Kemp's ridley Sea Turtle	<i>Lepidochelys kempii</i>
Ornate diamondback terrapin	<i>Malaclemys terrapin macrospilota</i>
Peninsula cooter	<i>Pseudemyspeninsularis</i>
Stinkpot	<i>Sternotherus odoratus</i>
Striped mud turtle	<i>Kinosternon baurii</i>
Suwannee cooter	<i>Chrysemys concinna suwanniensis</i>
<i>CROCODILIANS</i>	
American alligator*	<i>Alligator mississippiensis</i>
<i>SNAKES</i>	
Blue-striped ribbon snake	<i>Thamnophis sauritus nitae</i>

Reptile and Amphibian List for Crystal River NWR; species identified at Three Sisters Springs denoted with an *

Central Florida crowned snake	<i>Tantilla relicta neilli</i>
Corn snake	<i>Elaphe guttata guttata</i>
Dusky pigmy rattlesnake	<i>Sistrurus miliarius barbouri</i>
Eastern coral snake, Harlequin coral snake	<i>Micrurus fulvius</i>
Eastern diamondback rattlesnake	<i>Crotalus adamanteus</i>
Eastern garter snake	<i>Thamnophis sirtalis similis</i>
Eastern indigo snake	<i>Drymarchon corais couperi</i>
Florida cottonmouth	<i>Agkistrodon piscivorus conanti</i>
Florida kingsnake	<i>Lampropeltis getula floridana</i>
Peninsula ribbon snake*	<i>Thamnophis sauritus sackeni</i>
Southern black racer	<i>Coluber constrictor priapus</i>
Southern ring-neck snake	<i>Diadophis punctatus punctatus</i>
Yellow rat snake*	
LIZARDS	
Broad-headed skink	<i>Eumeces laticeps</i>
Brown anole*	<i>Anolis sagrei</i>
Common five-lined skink	<i>Eumeces fasciatus</i>
Cuban brown anole*	<i>Anolis sagrei sagrei</i>
Eastern glass lizard	<i>Ophisaurus ventralis</i>
Eastern slender glass lizard	<i>Ophisaurus attenuatus longicaudus</i>
Ground skink, Little brown skink	<i>Sincella lateralis</i>
Island glass lizard	<i>Ophisaurus compressus</i>
Northern green anole*	<i>Anolis carolinensis carolinensis</i>
Peninsula mole skink	<i>Eumeces egregius onocrepis</i>
Six-lined racerunner	<i>Cnemidophorus sexlineatus</i>

Reptile and Amphibian List for Crystal River NWR; species identified at Three Sisters Springs denoted with an *

Southeastern five-lined skink	<i>Eumeces inexpectatus</i>
Southern fence lizard	<i>Sceloporus undulatus</i>
AMPHIBIANS	
<i>FROGS</i>	
Barking treefrog	<i>Hyla gratiosa</i>
Bronze frog	<i>Rana clamitans clamitans</i>
Bullfrog	<i>Rana catesbeiana</i>
Eastern narrow-mouth toad	<i>Gastrophryne carolinensis</i>
Eastern spadefoot	<i>Scaphiopus holbrookii</i>
Florida chorus frog	<i>Pseudacris nigrita verrucosus</i>
Florida cricket frog	<i>Acris gryllus dorsalis</i>
Florida gopher frog	<i>Rana capito aesopus</i>
Green treefrog	<i>Hyla cinerea</i>
Greenhouse frog	<i>Eleutherodactylus planirostris</i>
Little grass frog	<i>Limnaoedus ocularis</i>
Oak toad	<i>Bufo quercicus</i>
Ornate chorus frog	<i>Pseudacris ornata</i>
Pig frog	<i>Rana grylio</i>
Pine woods treefrog	<i>Hyla femoralis</i>
River frog	<i>Rana heckscheri</i>
Striped chorus frog	<i>Pseudacris nigrita nigrita</i>
Southern leopard frog	<i>Rana sphenoccephala utriculara</i>
Southern spring peeper	<i>Pseudacris crucifer bartramiana</i>
Southern toad	<i>Bufo terrestris</i>
Squirrel treefrog	<i>Hyla squirella</i>

Reptile and Amphibian List for Crystal River NWR; species identified at Three Sisters Springs denoted with an *

SALAMANDERS	
Dwarf salamander	<i>Eurycea quadridigitata</i>
Eastern lesser siren	<i>Siren intermedia intermedia</i>
Eastern tiger salamander	<i>Ambystoma tigrinum tigrinum</i>
Greater siren	<i>Siren lacertian</i>
Gulf hammock dwarf siren	<i>Pseudobranchius striatus lustricolus</i>
Mole salamander	<i>Ambystoma talpoideum</i>
Northern slimy salamander	<i>Plethodon glutinosus</i>
One-toed amphiuma	<i>Amphiuma pholeter</i>
Peninsula newt	<i>Notophthalmus viridescens piaropicola</i>
Rusty mud salamander	<i>Pseudotriton montanus floridanus</i>
Southern dusky salamander	<i>Desmognathus auriculatus</i>
Striped newt	<i>Notophthalmus perstriatus</i>
Two-toed amphiuma	<i>Amphiuma means</i>

References:

USFWS. 2012. Chassahowitzka Comprehensive Conservation Plan.

Plant List for Three Sisters Springs (Curtis 2014)

Scientific Name	Common Name	Natural, Planted
Trees		
<i>Acer rubrum</i>	Red maple	Natural and planted
<i>Acer negundo</i>	Box elder	Planted
<i>Callestemon viminalis</i>	Bottlebrush	Non-native
<i>Carpinus caroliniana</i>	Hornbeam	Natural and planted
<i>Carya aquatic</i>	Water hickory	Planted
<i>Carya glabra</i>	Pignut hickory	Planted
<i>Carya ovata</i>	Pignut hickory	Natural
<i>Ceanothus americanus</i>	New Jersey tea	Natural
<i>Celtis laevigata</i>	Sugarberry	Natural and planted
<i>Cephalanthus occidentalis</i>	Buttonbush	Natural
<i>Ceratiola ericoides</i>	Rosemary	Natural
<i>Cercis canadensis</i>	Redbud	Natural
<i>Chionanthus virginicus</i>	Fringe tree	Natural and planted
<i>Cornus foemina</i>	Swamp dogwood	Natural
<i>Crataegus marshallii</i>	Parsley haw	Planted
<i>Cyrilla racemiflora</i>	White titi	Natural
<i>Decodon verticellatus</i>	Water willow	Natural
<i>Diospyros virginiana</i>	Persimmon	Natural
<i>Euonymus americanus</i>	Hearts-a-bustin	Natural
<i>Fraxinus caroliniana</i>	Pop ash	Planted
<i>Gleditsia aquatica</i>	Water locust	Planted
<i>Liquidambar styraciflua</i>	Sweet gum	Natural and planted
<i>Magnolia grandiflora</i>	Southern magnolia	Natural and planted
<i>Magnolia virginiana</i>	Sweet bay	Natural
<i>Morus rubra</i>	Red mulberry	Natural
<i>Nyssa biflora</i>	Blackgum	Natural
<i>Osmanthus americanus</i>	Wild olive	Natural
<i>Ostrya virginiana</i>	Hop hornbeam	Natural
<i>Persea borbonia</i>	Red bay	Natural
<i>Persea palustris</i>	Swamp bay	Natural
<i>Prunus serotina</i>	Black cherry	Natural
<i>Psychotria nervosa</i>	Wild coffee	Natural
<i>Quercus nigra</i>	Water oak	Natural
<i>Quercus laurifolia</i>	Laurel oak	Natural
<i>Quercus shumardii</i>	Shumard oak	Planted
<i>Quercus virginiana</i>	Live oak	Planted
<i>Sapindus saponaria</i>	Florida soapberry	Planted
<i>Sapium sebiferum</i>	Popcorn tree	Non-native
<i>Sassafras albidum</i>	Sassafras	Planted
<i>Schinus terebinthifolius</i>	Brazilian pepper	Non-native
<i>Styrax grandifolia</i>	Bigleaf snowbell	Natural

<i>Taxodium distichum</i>	Bald cypress	Natural and planted
<i>Tilia americana</i> var. <i>heterophylla</i>	Basswood	Planted
<i>Tilia floridana</i>	Florida basswood	Natural
<i>Ulmus alata</i>	Winged elm	Natural
<i>Ulmus americana</i> var. <i>floridana</i>	American elm, Florida elm	Natural
<i>Ulmus crassifolia</i>	Cedar elm	Natural
<i>Vaccinium arboreum</i>	Tree sparkleberry	Natural
<i>Ximenia americana</i>	Tallow wood	Natural
Evergreens and Palms		
<i>Juniperus virginiana</i> (<i>silicicola</i>)	Southern red cedar	Natural
<i>Rhapidophyllum hystrix</i>	Needle palm	Natural and planted
<i>Sabal minor</i>	Blue palmetto	Natural and planted
<i>Sabal palmetto</i>	Cabbage palm	Natural
<i>Serenoa repens</i>	Saw palmetto	Natural
<i>Taxodium ascendens</i>	Pond cypress	Natural
Shrubs and Small Trees		
<i>Acacia farnesiana</i>	Sweet acacia	Natural
<i>Aesculus pavia</i>	Red buckeye	Natural and planted
<i>Aralia spinosa</i>	Devil's walkingstick	Natural
<i>Aronia arbutifolia</i>	Red chokeberry	Natural
<i>Asimina longiflorea</i>	Slender pawpaw	Natural
<i>Asimina paryiflora</i>	Small-fruited pawpaw	Natural
<i>Asimina speciosa</i>	Woody pawpaw	Natural
<i>Avicennia nitida</i>	Black mangrove	Natural
<i>Baccharis angustifolia</i>	False willow	Natural
<i>Baccharis halimifolia</i>	Saltbush	Natural
<i>Callicarpa americana</i>	American beauty berry	Natural
<i>Carya glabra</i>	Pignut hickory	Natural
<i>Cephalanthus occidentalis</i>	Buttonbush	Natural
<i>Ceratiola ericoides</i>	Rosemary	Natural
<i>Chionanthus virginicus</i>	Fringe tree	Planted
<i>Chrysobalanus oblongifolius</i>	Gopher apple	Natural
<i>Cornus amomum</i>	Silky dogwood	Planted
<i>Cornus foemina</i>	Swamp dogwood	Natural
<i>Crataegus marshallii</i>	Parsley haw	Planted
<i>Decodon verticellatus</i>	Water willow	Natural
<i>Erythrina herbacea</i>	Cherokee bean	Planted
<i>Euonymus americanus</i>	Strawberry bush	Planted
<i>Forestiera ligustrina</i>	Upland swamp privet	Planted
<i>Fraxinus caroliniana</i>	Carolina ash	Natural
<i>Gaylussacia dumosa</i>	Dwarf huckleberry	Natural
<i>Gaylussacia frondosa</i>	Dangleberry	Natural
<i>Hamamelis virginiana</i>	Witch hazel	Planted
<i>Hamelia patens</i>	Firebush	Planted

<i>Hypericum hypericoides</i>	St. Andrew's cross	Natural
<i>Hypericum crux-andreae</i>	St. Peter's wort	Natural
<i>Hypericum tetrapetalum</i>	St. John's wort	Natural
<i>Ilex ambigua</i>	Sand holly	Natural
<i>Ilex cassine</i>	Dahoon holly	Planted
<i>Ilex glabra</i>	Gallberry	Natural
<i>Ilex vomitoria</i>	Yaupon Holly	Natural
<i>Itea virginica</i>	Virginia willow	Natural and planted
<i>Iva frutescens</i>	Marsh elder	Natural
<i>Languncularia racemosa</i>	White mangrove	Natural
<i>Lantana camara</i>	Lantana	Natural and non-native
<i>Leucothoe racemosa</i>	Fetterbush	Natural
<i>Lycium carolinianum</i>	Christmas berry	Natural
<i>Lyonia ferruginea</i>	Rusty staggerbush	Natural
<i>Lyonia fruticosa</i>	Coastal plain staggerbush	Natural
<i>Lyonia lingustrina</i>	Male berry	Natural
<i>Lyonia lucida</i>	Fetterbush lyonia	Natural
<i>Myrica cerifera</i>	Wax myrtle	Natural
<i>Myrica pusilla</i>	Dwarf wax myrtle	Natural
<i>Ptelea trifoliata</i>	Hop tree	Planted
<i>Pyracanta coccinea</i>	Firethorn	Non-native
<i>Rhamnus caroliniana</i>	Buckthorn	Natural
<i>Rhizophora mangle</i>	Red mangrove	Natural
<i>Rhododendron surrelatum</i>	Swamp azalea	Natural
<i>Rhus copallina</i>	Winged sumac	Natural
<i>Rosa palustris</i>	Swamp rose	Natural
<i>Rubus cuneifolius</i>	Blackberry	Natural
<i>Rubus trivialis</i>	Dewberry	Natural
<i>Salix caroliniatus</i>	Willow	Natural
<i>Sebastiania fruticosa</i>	Gulf Sebastian bush	Natural
<i>Viburnum caesium</i>	Deerberry	Natural
<i>Viburnum myrsinites</i>	Evergreen blueberry	Natural
<i>Viburnum nudum</i>	Possum haw	Natural
<i>Viburnum obovatum</i>	Walter's viburnum	Natural and planted
<i>Viburnum rufidulum</i>	Rusty black haw	Natural
<i>Viburnum scabrellum</i>	Viburnum	Natural
<i>Zanthoxylum americanum</i>	Toothache tree	Natural
<i>Zanthoxylum clava-herculis</i>	Hercules' club	Natural
Rushes		
<i>Juncus roemerianus</i>	Black needle rush	Natural
<i>Juncus scirpoides</i>	Needlepod rush	Natural
Sedges		
<i>Carex chapmannii</i>	Chapman's sedge	Natural
<i>Carex fissa</i>	Hammock sedge	Natural
<i>Carex gholsonii</i>	Gholson's sedge	Natural

<i>Carex godfreyi</i>	Godfrey's sedge	Natural
<i>Carex leptalea</i>	Slender sedge	Natural
<i>Carex longii</i>	Long's sedge	Natural
<i>Carex styloflexa</i>	Bent sedge	Natural
<i>Carex vexans</i>	Florida hammock sedge	Natural
<i>Cladium jamaicense</i>	Sawgrass	Natural
<i>Cyperus polystachyos</i>	Texas sedge	Natural
<i>Cyperus retrorsus</i>	Cylindric sedge	Natural
<i>Cyperus sequiflorus</i> now <i>Kyllinga odorata</i>	Fragrant spikesedge	Natural
<i>Dichromena colorata</i>	White-top sedge	Natural
<i>Eleocharis albida</i>	White spikerush	Natural
<i>Eleocharis cellulose</i>	Gulf spikerush	Natural
<i>Eleocharis parvula</i>	Dwarf spikerush	Natural
<i>Fimbristylis spadicea</i> (<i>castanea</i>)	Marsh fimbry	Natural
<i>Fimbristylis fusca puberula</i>	Hairy fimbry	Natural
<i>Fuirena scirpoidea</i>	Southern umbrella sedge	Natural
<i>Rhynchospora fascicularis</i>	Fascicled beaksedge	Natural
<i>Rhynchospora plumose</i>	Plumed beaksedge	Natural
<i>Scirpus californicus</i>	Giant bulrush	Natural
<i>Scirpus americanus (olneyi)</i>	American bulrush	Natural
<i>Scirpus robustus</i>	Saltmarsh bulrush	Natural
<i>Scirpus validus</i>	Soft-stem bulrush	Natural
Grasses		
<i>Andropogon virginicus</i>	Broomsedge	Natural
<i>Aristida spiciformis</i>	Bottlebrush three-awn	Natural
<i>Aristida stricta</i>	Wire grass	Natural
<i>Cenchrus incertus</i>	Coast sandspur	Natural
<i>Cynodon dactylon</i>	Bermuda grass	Natural
<i>Distichlis spicata</i>	Salt grass	Natural
<i>Imperata cylindrica</i>	Cogon grass	Non-native
<i>Leptochloa fascicularis</i>	Bearded sprangletop	Natural
<i>Panicum commutatum</i>	Variable panic grass	Natural
<i>Panicum hemitomon</i>	Maidencane	Natural
<i>Panicum tenue</i> now <i>Dichanthelium ensifolium</i>	Witch grass	Natural
<i>Panicum virgatum</i>	Switchgrass	Natural
<i>Panicum repens</i>	Torpedo grass	Non-native
<i>Paspalum floridanum</i>	Florida crowngrass	Natural
<i>Paspalum notatum</i>	Bahia grass	Natural
<i>Setaria geniculata</i>	Foxtail grass	Natural
<i>Sorghastrum secundum</i>	Lopsided Indian grass	Natural
<i>Sorghum helpense</i>	Johnson grass	Natural
<i>Spartina alterniflora</i>	Smooth cordgrass	Natural

<i>Spartina patens</i>	Cordgrass	Natural
<i>Triticum aestivum</i>	Wheat	Non-native
Ferns		
<i>Acrostichum danaeifolium</i>	Giant leather fern	Natural
<i>Blechnum serrulatum</i>	Swamp fern	Natural
<i>Lygodium japonicum</i>	Japanese climbing fern	Non-native
<i>Osmunda regalis</i>	Royal fern	Natural
<i>Phlebodium regalis</i>	Resurrection fern	Natural
<i>Pteridium aquilinum</i>	Bracken fern	Natural
<i>Pteris vittata</i>	Chinese brake fern	Non-native
<i>Thelypteris normalis</i>	Wood fern	Natural
<i>Vittaria lineate</i>	Shoestring fern	Natural
Vines		
<i>Dioscorea bulbifera</i>	Air potato	Non-native
<i>Paederia foetida</i>	Skunk vine	Non-native
Horsetails		
<i>Equisetum hyemale</i>	Horsetail	Natural
Aquatic Species		
<i>Colocasia esculenta</i>	Wild taro	Non-native
<i>Hydrilla verticillata</i>	Hydrilla	Non-native

References:

Curtis, L. 2014. Carex and associates of Three Sisters Springs. Unpublished data.